8

OBSERVATIONS AND CASES

RELATING TO THE

OPERATION

FOR

ARTIFICIAL PUPIL;

IN A LETTER FROM

MR. MAUNOIR OF GENEVA,

TO

PROFESSOR SCARPA OF PAVIA,

WITH THE

PROFESSOR'S ANSWER.

COMMUNICATED BY

DR. MARCET.

Read May 28, 1816.

Letter from MR. MAUNOIR, *to* PROFESSOR SCARPA.

SIR,

I HAVE delayed to convey to you the assurance of my gratitude for that confidence in my skill with which you have inspired the Marquis of Beaumanoir, until I should have some interesting information to give you relative to his case, and more especially until I should have in some degree justified your favourable opinion of me. I have been

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indebted to you for one of the greatest enjoyments which can be experienced; that of creating, as it were, the faculty of sight, in a person whom time had not yet accustomed to the privation of a sense so precious, and who at the same time had lost nearly every hope of ever recovering it. I am indebted to you also for other, and still greater obligations. The charm of your letters, the friendship and esteem with which you honour me, and the excellence of your instructions have been to me the most powerful stimulants. You make me love my profession with greater ardour, and excite in my mind the liveliest desire of extending its limits. I transcribe for you in the words of the Marquis himself, the following account of the origin of his misfortune; the most trifling circumstances relative to this case cannot but be highly interesting.

"In the severe winter of 1784, I was first attacked by an inflammation in both my eyes, which prevented me from performing my military duty: for five weeks I had recourse to the following remedies: blisters on the nape of the neck, foot baths, whites of eggs applied to the eyes, &c. In November, 1796, my sight was affected by a second inflammation. I had been wounded about this time and was copiously blooded to remove a difficulty of speech caused by the effects of the wound, which was received in the stomach, grazing the left ribs. Finding myself in the course of the winter affected with an incessant stammering, the bleedings were

repeated, during all which time there was a constant inflammation of the eyes. In the month of May they were restored to their natural state, and I recovered the entire use of my speech; but could neither give myself up to my professional service, nor to any thing which demanded fixed and serious attention.

"During a journey in Russia towards the end of the same year, I suffered from several slighter attacks of inflammation, which subsided without the application of any remedies. Having been obliged to pass the winter of 1798 in Siberia, the brightness of the snow, the rigour of the climate, the violence of the whirlwinds, to which I was frequently exposed, the ardent reflection of the sun upon the snow and ice, the penetrating smoke which fills the greatest part of the habitations of this dreary country, all these causes contributed to keep my eyes, which were already weak and delicate, in a continual state of inflammation.

"In 1800, I could neither write nor read. A little while after, I was still able to perceive the light, but less with the left eye than with the right. In the month of August of the same year, during my residence at Vienna, I consulted several eminent oculists, and among others Mr. Beer, who was of opinion that my sight could be restored only by an operation on the left eye, which he performed himself, but without success. Since that period I have

entirely lost the use of that eye; and the inflammation which resulted from the operation, did not subside, notwithstanding the application of every remedy, before the month of May in the following year.

"In 1806, I suffered again from another inflammation which lasted three weeks, after which time I entirely lost the power of conducting myself.

"In 1810, having become totally blind, I placed myself under the direction of Dr. Frederick at Vienna, and in the month of September of the same year, recovered the use of the right eye sufficiently to conduct myself alone. This advantage was but of short duration; intervals of more or less repose, and of severe inflammation, succeeded each other, until the year 1812, when I again totally lost my sight, preserving only the power of distinguishing, with my right eye, light from darkness.

"In 1813, I resigned myself entirely to the will of Providence, my medical advisers having declared that they could do nothing more for me. However being at Pavia in the year 1814, I consulted the famous Scarpa, who recommended me to place myself under the direction of Professor Maunoir of Geneva."

The state of his eyes when I saw them for the

first time at the beginning of April, 1815, was as follows.

They were large, prominent, the upper eyelid rather red than white, and slightly swelled; the conjunctiva covered with vessels a little too full; the iris of a bluish grey colour, and presenting, instead of the pupil in the centre, a white spot of the size of a small pin's head. This spot which could only be the corresponding portion of the capsule of the crystalline, seemed to be adherent to the iris in both the eyes, and was of a whitish grey colour in the left eye, and milk-white in the right. It was impossible to decide *a priori* whether the crystalline was transparent or opake, since it was entirely hidden by the iris, and by a small portion of the capsule. The Marquis preserved the faculty of distinguishing very clearly the transition from darkness to light; but this power was much weaker in the left eye than in the right.

Saturday, 12th of August, 1815, I operated on the right eye in the following manner.

The patient being seated on a chair and having the head inclined upon a cushion, I placed myself behind him, and with the forefinger of the left hand confining the upper eyelid, whilst an assistant depressed the lower; I made with the right hand a semicircular incision in the lower and external part

of the cornea. This incision occupied a full third of the circumference of the membrane. A quick movement of the eye during the operation, obliged me to bring the edge of the instrument so low as to cut slightly the conjunctiva, which occasioned a slight hæmorrhage; but the application of a sponge dipped in cold water, and a moment's repose remedied this little accident. On reopening the eye, the iris was seen projecting a little from the wound in the cornea. I replaced it with the blunt point of my scissors. Introducing the two blades closed into the anterior chamber, and then opening them, I caused the pointed blade to penetrate the iris, leaving the blunt blade between that membrane and the cornea; then closing the scissors, a perpendicular incision of the iris resulted, describing a little more than half the chord of an arc of two-fifths of the circumference of the iris, traced on the side of the temple. This first incision not having occasioned the formation of a pupil of the necessary size; I introduced the scissors into the iris a second time a little obliquely; and immediately the pupil appeared of a satisfactory form and size, but exhibiting the crystalline entirely opake.

The second stroke of the scissors had divided the capsula: I therefore introduced a small curette, in order to endeavour to destroy what adhered of the crystalline to the shrunk and contracted circumference of the old pupil. It will be seen

presently that this attempt did not succeed. Lastly I effected the passage of a portion of the opake lens by means of a slight pressure with a large scoop exercised on the lower part of the globe of the eye. The crystalline, which was of a cheesy consistence, came out with the greatest ease, and though it was not entirely removed, yet a sufficient quantity was discharged to leave the artificial pupil of a most perfect black. This new pupil was on the side of the temple; and at the exterior and lower part of the iris. The old pupil which had neither changed in form or size, and remained always closed by a white opake body, was not comprised within the area of the new pupil, but was situated internally, and above it. The new pupil had the form of an irregular trapezium. The Marquis received immediately some confused idea of objects in the light.

The eye was reopened the fifth day after the operation. The wound in the cornea was well healed, and the conjunctiva scarcely red. The patient had suffered no pain, but when the eye was exposed to the light, he saw nothing; the new pupil which had preserved its form and size was obstructed by that portion of the crystalline which I had not been able to extract, and which was extremely swelled. I hoped however that this fragment of the crystalline would sooner or later be absorbed either entirely, or in part, and that the new pupil would in the end become black; but I

was much afraid of the formation of a gutta serena. During the first three weeks after the operation, the Marquis of Beaumanoir distinguished no one object, and his despair as well as my anxiety continued daily increasing.

Notwithstanding, I saw the lower edge of the crystalline gradually disappear, and the pupil in the corresponding part become black, and yet in spite of this favourable change, the sight did not return. All at once, early in the month of September, he distinguished first his hand, then his fingers, then the houses in the street. Since this fortunate moment his sight has gradually acquired strength in proportion as the crystalline was absorbed.

At present, December 1, he can read written characters of the size of a fourth of an inch; he distinguishes the hour by the clock; he perceives at the same time the two hands of his watch; he conducts himself with ease in the street or in the road; he avoids obstacles, distinguishing men, women, children, and animals; he does not confound a willow with a poplar, or a poplar with an oak. He evidently gains something every day, and makes a sufficiently apparent progress.

The Marquis wished earnestly that I should operate on the left eye. I did it with repugnance, and not till I had warned him that I expected from

it little or no advantage. September 11, I made an incision in the cornca of this eye, in the same manner as I had before done in that of the right; and at the very instant the iris came out of the wound swelled and enlarged by the crystalline which was spontaneously displaced, so that the lens was in fact without the eye, forming a hernia of which the iris was the bag, veiling it closely, and enveloping it on every side. I gave a stroke of the scissors to the tumor, and the crystalline came out with the grcatest ease, to all appearance whole, but extremely small. The iris did not re-enter spontaneously, but it was easy to restore it to its place. The pupil then appearing very small, I gave it a second stroke with the scissors, when the pupil which was of an irregular form, appeared of sufficient size and of a perfect black.

When I examined the eye on the fifth day after the operation, I found the pupil partly obstructed by the opake capsula, and partly contracted, but still sufficiently visible in the exterior and lower part of the iris, with a small round opening of a perfcct black; it appears more than probable that if the retina had not been previously enfcebled by a violent disorder resulting from the first operation, the Marquis would have rccovered the sight of his eye to a certain degrce, without any difficulty. But the new pupil has remained during nearly a month, like that of an eye discased with an amaurosis. It

is within a very few days only that this eye can be said to have gained something, and the Marquis can now distinguish the moon, a lighted candle, the fire, or any bright objects which pass before him. The only forms which he has yet been able to ascertain with precision, are the square frames of his windows.

I will not attempt to give you any idea of the form of the crystalline, which remains in the right eye, because it undergoes some change every week, and because it is probable that these changes will last until its entire absorption. I might assist this operation, in making a fresh incision with a needle upon the remainder of the crystalline, but I am unwilling to cause the slightest irritation to the eye, as long as the unassisted force of nature appears to act in an advantageous manner. It will not be till the natural force appears to be languid, or rather entirely inefficacious, that I shall expose by means of an incision a new crystalline surface to the action of the aqueous humour. With respect to the iris of the left eye, there is no crystalline to dissolve, and in consequence I propose to give it shortly a sufficient extent.

I proceed to lay before you some account of two other operations for artificial pupil, of which one took place a few days before that performed on the Marquis, and the other in the course of the last month. I copy simply my notes taken at the time.

"Mr. Cherbuliez, bookseller, 46 or 48 years of age, has had since his infancy an albugo on the left eye, caused by the small-pox; it occupies a full third of the cornea on the side nearest the temple, and the rim of the pupil almost adheres to this disordered membrane, a very small portion of it is free, which makes the edge of a pupil of the size of a small grain of millet, with which Mr. Cherbuliez can only see indistinctly, with pain, and very near. The cornea of the right eye is irregularly and nearly always obscured by a species of mist which is the consequence of frequent ophthalmia. This same eye had been lately affected with amaurosis, from which it had very considerably recovered. It was but of little use to the patient. The crystalline of the left eye was evidently transparent, and it became necessary to take care of it. I operated on the third of August, 1815, in the following manner:

"The patient was seated in a chair, his head resting on the breast of an assistant who at the same time raised the upper eye-lid. I placed myself behind him, and with the forefinger of the left hand, depressed the lower eye-lid. I then made with the right hand a semicircular incision of about three lines in length, and as much upon the opake part of the cornea as upon the transparent.

"I then introduced into the wound my blunt scissors, and penetrating with one of the blades through

the small pupil which I have mentioned, I succeeded in making an incision without wounding the capsula or the crystalline, cutting the orbicular muscle in a transverse direction, and continuing nearly parallel between the fibres of the diverging or radiating muscle; this incision describes an entire radius of the disc of the iris. Its immediate result was a perfect triangular pupil of the most brilliant black.

"Every thing went on well during the first 50 hours, when Mr. Cherbuliez having made a violent effort in going to stool, caused a small hernia of the iris. This accident did not change the form or the size of the pupil. I have three times effected the depression of this rupture of the iris, by introducing a needle for the cataract. At present the staphyloma is little or nothing.

"Mr. Cherbuliez has resumed the ordinary course of his affairs, he writes and can read the finest written characters, nor is his eye fatigued even by a long series of occupation."

I come now to the account of the last operation which I have performed.

"A woman of the name of Saillard, 26 years of age, and mother of an infant of some months, received a thorn in her left eye, as she was cutting wood in a forest, about two years ago. She di

not suffer much at the time, but the consequences of the accident were fatal to the sight of the eye. Her state when I saw her for the first time was as follows:

"The pupil which was shrunk and irregularly fringed, and entirely incapable of any movement of contraction or dilatation, was partly covered by a spot or shell, milk-white and apparently in conjunction with the iris. Where the pupil was not covered by this body, it appeared to me at first sight black, and the woman was still able to distinguish objects confusedly with this eye. The right eye had had a cataract for nearly a year, and the pupil was immoveable and fringed, the iris appeared to have been diseased, and the watery humour had not a healthy transparence.

"Being much occupied by a press of business, and not wishing to occasion a loss of time to the patient; thinking besides that the crystalline of the left eye was transparent, and that I had nothing to do but to increase the pupil which was too small, I took with me only my scissors blunted at both points; but at the moment of the operation, and favoured by a bright day, I perceived that the crystalline was decidedly opake, though at the same time in such a manner, that I could easily have supposed it to be transparent the first time I observed it, and especially in a situation where the light was not favourable.

"It was now evident, however, that it was necessary to extract the crystalline, and that if I enlarged the pupil with my blunted scissors, it could only be by cutting the iris in the upper part of its disc, an operation which would render the extraction of the crystalline difficult, and even perhaps impossible, since it was probable that some extraneous substance would adhere to it. In consequence of these considerations, I made my decision instantly, and performed the operation in the following manner:

"I first made an incision in the lower part of the cornea; then introducing the point of my instrument into the lower part of the iris, the puncture gave me an opening of the size of a pin's head, sufficient to allow the passage of one of the blunted points of my scissors, with which I cut the narrow strip comprised between the hole caused by the knife and the natural pupil; I then obtained immediately a pupil of a good size, and which exhibited a crystalline humour of a whitish grey colour. Then observing that the compression which I exercised upon the eye appeared in no degree to move the crystalline, I passed behind it a very small scoop, and drew it out of the eye by this means, with the greatest facility. The pupil was then of a perfect black, but the white spot had changed its situation and now obstructed the lips of the wound in the cornea. After having endeavoured in vain to remove it with the scoop, I wa

obliged to seize it with the forceps, by which means I drew it out, together with a transparent membrane which adhered to it, and seemed to detach itself from the iris: it proved on examination to be that of the crystalline. The white body was of the size of a lentil, and entirely of a cartilaginous nature. The patient saw immediately, and distinguished perfectly every object which I presented to the eye, but they all appeared coloured with a tinge of blue.

"Six days after the operation, I shewed the woman to my society of medicine, where she was seen by Messrs. Odier, Peschier, Aubert, Colladon, De Roches and Morin. The cicatrix of the cornea was in a healthy state, the pupil of a good size and of a perfect black, the sclerotica was scarcely red, and the patient saw very small objects tolerably well. She returned to her house at Chable the next morning, seven days after the operation."

I have the honour to be, &c. &c.

J. P. MAUNOIR.

Geneva, December, 1815.

Letter from PROFESSOR SCARPA *to* MR. MAUNOIR.

SIR,

I have received with the highest satisfaction the account with which you have favoured me of the success of your operation on the Marquis of Beaumanoir. It gives me great pleasure to have been in any degree instrumental to the service you have rendered him, and I request you to present to him my hearty congratulations.

Every lover of the science cannot but feel interested in the narration of the difficulty which attended this operation, as well as that performed on Mrs. Saillard, on account of the opake crystalline which in both cases adhered to the lower circumference of the iris, and the edge of the closed pupil. This has given me occasion to make some reflections on the subject, which I take the liberty of communicating to you with my usual freedom.

The detail of both the operations in the above mentioned cases, exposes a certain degree of difficulty and uncertainty in the proceeding, which I should wish to see removed or corrected; and I have great hopes that you will be able to attain this desirable object.

In the first place, I am of opinion that it is not necessary to be scrupulous whether the crystalline

be partly or entirely opake, whenever the capsule is opake, and adheres to the iris behind the edge of the interior and inclosed pupil. In this case, only one remedy can be pointed out, namely, the removal of the opake adherent capsule, and consequently of the crystalline, whether it be transparent or opake.—In the second place, I think there is no reason to doubt that, in similar cases, it is adviseable to make an incision upon the iris proportioned to the size of the body to be extracted, rather than to make it small, which obliges the operator to divide the crystalline and the capsule, with the intention of extracting a part, and of abandoning the rest to the powers of absorption.—Thirdly, I would establish as a fundamental principle in similar cases, that after the complete extraction of the crystalline with its opake capsule, by means of the least possible introduction of instruments, the artificial pupil ought not to be too near the incision in the cornea, and, consequently, not too near the cicatrix occasioned by it.

The causes of the obstacles, to which you were exposed in the two cases above mentioned, may, I think, be perceived from a consideration of the principles I have just stated. In both the incision in the iris was too small in proportion to the size of the body to be extracted; and in both, the position of the artificial pupil was very disadvantageous; that is to say, on the side of the temple and close to the incision in the cornea.

After reflecting attentively upon this situation of the artificial pupil, and upon the obstacles which it presents to the operator, it appears to me, if I am not greatly deceived, that a method of operation compounded of that of Wenzel, and of your own, would perfectly answer the desired end. Wenzel, as you are aware, made an incision upon the cornea and the iris with a single stroke of his instrument, taking care that this transverse incision should pass through or underneath the centre of the inclosed pupil. He then took off, by means of the scissors, a portion of the edge of the iris, for the double purpose of extracting with facility the opake crystalline with its capsule, and of leaving a permanent artificial pupil of sufficient size. In the method which I would suggest, after having made, in the manner of Wenzel, a transverse incision in the iris and in the cornea, I would introduce your scissors, blunted at both points, into the anterior chamber of the aqueous humour, with which I would make an incision in the iris, diverging from the cut made by the knife, so that your usual triangular edge might be the result, having a curvilinear side *. This aperture, which requires only a single stroke of the scissors, will be, I think, sufficiently large to allow easy egress to the crystalline and the capsule; and this so much the more easily, in proportion as the point of adherence of the capsule to the iris, is comprehended either entirely, or in a great mea

* See Plate V. Fig. I.

sure, within the two incisions. By this means the facility of making the crystalline and the capsule pass obliquely out from the iris will be increased on account of the enlarged space that will result from the cut with the scissors diverging from that made by the knife; and I should prefer this incision with the knife to the puncture made by you in the iris of Saillard, to afford a passage to the blade of the scissors. Besides this, the direction and the situation of the triangular edge of the iris will be calculated to leave a pupil not only permanent, and sufficiently large, but also placed opposite to the cut in the cornea, and accordingly more convenient for the purposes of vision; especially if it fall upon the side of the iris nearest the nose, which ought, if possible, always to be the case.

I have thus briefly given you my opinion on this subject. You will recollect that you permitted me to make objections and suggestions. I have done so; and it now belongs to you in the course of your practice to make trial of the method I propose, and either to confirm or reject it, or, which will not be difficult to you, to suggest some new and more practicable expedient. It is certain that this complicated case of the pupil, that is to say, where the crystalline is found opake, together with the capsule adhering to the iris, requires an exertion of genius and skill, united to a more perfect method of operation, than that which has been hi-

therto practised. Your researches have already been so numerous and so successful in this branch of our profession, that we have a right to expect you to proceed in the completion of your work. Till within a very few years, our knowledge respecting the artificial pupil, and the method of conducting the operation, was involved in great obscurity, and practice was sometimes even in opposition to the known anatomy of the eye. It is by solid and fixed principles alone that we ought to be guided in all that variety of complicated cases, which frequently accompany and aggravate the inclosed pupil. In estimating the extent of the services which you have already rendered to the profession, I run no risk of errour in enumerating the following facts as the results of your most useful researches.

1. That no instrument is so proper as the scissors for making an incision in the iris.

2. That to do this, when there is no complica tion resulting from a cataract, a very small inci sion in the cornea is sufficient, about half the siz of that which is made for the extraction of th crystalline,—a fact which on many accounts is c the highest importance.

3. That the formation of a triangular edge i the iris by means of a double incision with th

scissors, is the most easy and least painful of all the methods hitherto proposed for obtaining a *permanent* artificial pupil.

4. That the spots of the cornea present no obstacle, because it is possible to produce the artificial pupil in that part of the cornea remaining transparent, in the quarter opposite to that in which the incision is made,—a fact of the greatest importance.

5. That it is possible to obtain the artificial pupil without injury to the crystalline or its capsule, whenever these parts are preserved transparent, in spite of complete confusion in the iris.

If to these advantages, which your method of operation possesses over all those hitherto practised, you are able to add that of rendering as little laborious as possible the manner of making the artificial pupil, in those cases where it is necessary to remove at the same time the crystalline and its opake capsule adherent to the lower surface of the iris, you will fulfil not only all my wishes, but those of all who are interested in the cause of humanity, and in the progress of science. The state of my health does not permit me to follow you in this useful career, and leaves me only the power of witnessing and of applauding your success. I have much pleasure in informing you that your scissors have begun to be used here, and Signor Morigi,

my successor in the chair of surgery, has lately availed himself of them with great success in an operation for the artificial pupil. He is a man of considerable ability, whom you will find mentioned with deserved praise in several places of my work.

I have the honour to be your most sincere friend and humble servant,

A. SCARPA.

Pavia, Jan. 1, 1816.

THE END.

G. WOODFALL, PRINTER,
ANGEL COURT, SKINNER STREET, LONDON.

9

Treatise on Opthalmy.

A

TREATISE

ON

OPTHALMY;

AND THOSE

DISEASES WHICH ARE INDUCED BY INFLAMMATIONS OF THE EYES.

WITH

NEW METHODS OF CURE.

BY

EDWARD MOORE NOBLE,

SURGEON.

PART THE FIRST.

Birmingham:

PRINTED BY SWINNEY & HAWKINS;

FOR

G. G. & J. ROBINSON, PATERNOSTER-ROW, LONDON;

CREECH, EDINBURGH; AND M'KENZIE, DUBLIN.

1800.

3s.

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PREFACE.

TO practice any particular branch of the medical profeſsion, with ſucceſs, requires a general knowledge of the whole ſcience; at the ſame time, it must be acknowledged, that if, from any peculiar coincidence of circumstances, a person's attention is more immediately directed to one claſs of diseases, he acquires a greater power of discrimination, and, from the mind dwelling much on one ſubject, he frequently obtains new ideas, and ſtrikes out into a new and preferable mode of practice.

It is of little importance to my readers, to be told, how my attention came to be directed more particularly to the treatment of diseases of the eyes; it is ſufficient to inform them, that for ſome years, I have had a considerable practice in that department of my profeſsion, and that the hopes of being able to improve that particular branch, has principally induced me to publish this Treatise.

It is not however on that account ſolely, that I have ventured to appear before the public. The art of curing diseases has, of late years, made rapid ſtrides towards arriving at that *acmé* of perfection, beyond which it is not in the power of man to advance it. The light which has been let in upon us, by the doctrines of that great

genius, Dr. John Brown, and ſo ably ſeconded by a Darwin, and a Beddoes, has laid the foundation of a new era in the annals of Medicine, and has opened new views to the practitioner, in the theory and treatment of diseases.

Since that epoch no regular treatise, on the inflammation of the eye, has appeared, in which the mode of treatment has been founded on ſyſtematic principles; and when we consider the importance and delicacy of that organ, we ſhall be ſurprised to find, how little has been done, towards arriving at a rational plan of cure.

The regular routine of bleeding, blisters and cathartics, with a variety of external applications, are generally indiscrimin-

ately applied, with little attention to the nature, or the period of the disease; and there are ſome practitioners who act with ſtill greater inconsistency, and maintain, that it is uselesſ to inspect the eye; that it causes an unneceſsary degree of irritation; and that we ought to trust entirely to internal medicines.

It is my intention to endeavour to point out the propriety of a certain mode of treatment, and to discriminate the proper time for the use of different applications.

On the first attack of an Opthalmy, the general circulation of the maſs of fluids is not evidently increased, though it may be ſo in a ſhort time, from the pain and irritation of the eye; I therefore consider

the disease as a topical affection, and that we ought chiefly to rely on local applications for a cure.

In ſpeaking of the causes of Opthalmy, I have divided them into an increase of ſtimulus, or an increase of that ſomething to which I have given the name of the irritable principle, but whether it ought to be considered as a quality of vitality, or as ſupplied by the brain, or from the atmosphere, I have not ventured to risk an opinion.

It probably may be thought, for a Treatise on the Opthalmy, I have entered into too long a digreſsion upon the effects of *ſtimuli* applied to the body, and have been too prolix upon the laws relative to the accu-

mulation or exhaustion of this irritable principle. Much more might undoubtedly have been ſaid, which would have better elucidated the doctrine, but I wished not to take up too much of my reader's time upon the discuſsion, and I knew not how, in ſaying leſs, to properly explain my ideas on those ſubjects.

It may, perhaps, not be improper in this place, to take a general view of what is intended to be given in the Second Part, which will conclude this Treatise.

In the first place I ſhall enter upon the cure of the inflammation of the eye.

In the laws of the animal economy, there is ſcarce any fact more clear than that a

ſtimulus ſtronger than usual being applied to the moving fibre, makes it leſs easily excited into action, and that on the ſudden ſubstraction of this increased *ſtimulus*, the motions of the part will be diminished.

Upon this law will depend my method of cure of the Opthalmy. The treatment of the disease admits of a variety of modifications; but my principal object will be the application of a *ſtimulus*, in a peculiar manner, as great as the eye can bear, without being thrown into convulsive motions, and when this *ſtimulus* loses its effect of causing pain, to ſuddenly remove it, and diminish all *ſtimuli*, or irritating causes, as much as poſsible.

By these means a diminished action of the veſsels will be induced, the pain will be moderated, and an alleviation of the ſymptoms will take place.

By convulsive motions are meant, those motions which take place from the injudicious application of too powerful ſtimulants; as the tincture of opium, which has been ſo much extolled, under the name of the *Tinctura Thebaica*, by Mr. Ware, from an old *formula* of the College of Physicians. The tincture of opium is the most efficacious application that has ever been recommended to the public for inflammations of the eye; but, like all other powerful medicines, whose *modus operandi* we are not well acquainted with, it is daily employed improperly, to the great pain and distreſs

f the patient. It will be my endeavour, n the ſuceeding part, to lay down rules or its application, and to explain on what s ſalutary effect depends.

The better to explain my mode of treatment and its effect, I ſhall insert a few ases, by which I hope the rational practioner, in prescribing for inflammations of he eyes, will be enabled to appropriate he applications to each individual ſubject, nd may act with a rational probability of ccceſs.

I ſhall then proceed to the cure of the pthalmy which has been of long continuance, and has put on an atonic form. his will be followed by the cure of different diseased actions of the veſsels of the

cornea and *conjunctiva*. To the whole wil be ſubjoined, a concise inquiry into th powers and efficacy of those application which are generally made use of in inflam mations of the eyes.

I hope to be able to ſend the Secon Part, which will conclude this Treatis to the preſs the beginning of next year.

Birmingham, September 1,
1800.

ERRATA—Page 128, line 21, for averted, read everted.
— 144, — 14, for infection, read affection.

TREATISE

ON THE

OPTHALMY, *&c.*

INTRODUCTION.

THE Eye, from its peculiar organization d the delicacy of its ſtructure, with the icknefs and variety of its motions, besides ing exposed to all those things which ex- e inflammation in general, is affected by ariety of noctious powers, which applied another part would prove perfectly harm- s: on these accounts, inflammations of the es are perhaps more frequent than of any ner part, and, though not often dangerous

to life, are always troublesome, and, fro
the importance of the organ concerned, re
der a ſpeedy removal of it extremely deſi
able.

Although total blindneſs from an Otha
my is not very frequent, yet a partial defe
in the ſight is not uncommon, and cas
unfortunately ſometimes occur in which t
total loſs of that important ſense, with co
siderable pain and deformity, is the tern
nation of the disease.

The hopes of being able to lay dowı
more rational plan of cure, and to point
the impropriety and danger of that indisc
minate manner followed in the treatmen
Opthalmy, which is too generally adopt
induced the Author to ſend into the wo
the following pages. After treating on
history, the causes, and cure of the disea
he will concisely inquire into the effic
of a great number of applications to the e
which are in general and esteemed use.

THE DEFINITION AND HISTORY OF OPTHALMY.

WHAT is usually meant by the term Opthalmy, is a redneſs and inflammation, with pain, of the *tunica conjunctiva*, or that membrane which covers the anterior part of the eye, where it ceases to be transparent, and lines the inside of the lids; with pain of the eye, on exposure to light; for though an inflammation will ſometimes arise in the coats and globe of the eye itself, as a primary disease, yet that is ſo very ſeldom the case, comparatively with the frequency of the inflammation of the *tunica conjunctiva*, is not, commonly, to be ſeparately considered.

On the first attack of an Opthalmy, the *tunica conjunctiva* becomes ſlightly red, with an increase of heat of the part; the eye feels dry, and, at times, as if there were small particles of dust in it; the lids do not move with their accustomed ease, and

the light causes ſome uneasineſs. As the inflammation increaſes, the whole of the *adnata* becomes more red, and, to that degree, that, in a violent attack, there is not the least appearance of whiteneſs, neither can any veſsel be distinctly seen, but an uniform fiery redneſs extending over the whole surface; the thickneſs of it is generally a little increased, and at times it is ſo much enlarged, as to make the *cornea* look as if it was depreſsed or sunk in the globe, which indicates a very violent disease, and has been called *chemosis* by authors: the ſensation of heat becomes greater, and the patient feels as if pins or needles were piercing the eye, with a discharge of tears: the light becomes intolerable, even a ſmall quantity produces great pain, with a copious flow of tears, and the lids are red and ſwelled. The pain is now not confined to the eye and lids only, but extends to the temple and forehead, and is ſometimes diffused over the whole head. The irritation and pain produced are occasionally ſo

great, as to excite a considerable degree of fever, which, at times, though very ſeldom, is ſo great as to induce delirium.

Though the whole of the *conjunctiva* is generally inflamed, in nearly an equal degree, yet at times the redneſs is confined only to a ſmall part, the other portion preſerving its natural colour and appearance. When this happens, it will usually be found, that either ſome ſmall extraneous body is adhering to the eye, or that there is a ſmall pustule or ulcer on the *adnata*.

The light also, which, even in ſlight ophthalmies, commonly gives pain, ſometimes causes very little irritation, though the appearance of the eye would ſtrongly indicate the contrary; which must arise from the inflammation being confined to the external parts of the eye. On the other hand, in some cases, in which we ſuppose the *tunica choroides* and the internal parts mostly to be affected, though the appearance of the *con-*

junctiva ſhall be little changed, the ſmall
est quantity of light causes great pain.

The redneſs or turgescence of the veſsel
on the first appearance of the opthalm
never extends to the *cornea*, but is produc
by the increased and diseased action, b
which new veſsels are formed, or the o
ones elongated. It does not appear prob
ble, that the veſsels, which are ſeen on t
cornea transparens are caused by the diam
ters of the old ones being enlarged, a
allowing admiſsion to the red particles of t
blood, as they are never visible till the i
flammation has continued ſome time, thou
it ſhould be very violent and the action
the part great; besides, were the veſsels
be merely enlarged, the whole ſubstance
the *cornea* would be red, whereas, unleſs
very ſevere and obstinate cases, it is alwa
confined to the external ſurface, and f
quently the veſsels are very few in numb
with generally either a thickening and o
city of the *cornea*, or an ulcer in the ſa
part.

The discharge of tears is usually rather copious and the eye always moist; but cases are ſometimes met with, in which the eye has been dry from the beginning, and continues ſo during the whole of the complaint: this arises from the irritation not being ſo great as to produce the ſenſation of pain, and on that account, the action of the lachrymal gland is not called into undue exertion.

It often happens, that either the discharge from the lachrymal gland, or from the ſmall exhalent arteries of the *conjunctiva*, is ſo thickened as to form an adhesive matter, which firmly glews the lids together, more ſpecially in a morning, after ſleep. This, as it adds much to the irritation and pain in the part, ſhould be prevented by the application of ſome bland ſoft ointment, to the edges of the lids, at bed time.

If the inflammation, from the beginning, has not been violent, or attended with much pain, and does not ſoon subside, from ſome

peculiar want of action in the part, or fr
the inflammation being occasionally i
creased, by want of attention to remo
any exciting causes, or the use of imp
per applications, the eye will beco
ſo accustomed to its new motions, t
the inflammation may be continued fo
great length of time, without occasion
any opacity of the *cornea*, or being prod
tive of much pain, and has generally b
called the *atonic* or paſsive inflammatio

But when the inflammation has conti
ed with violence for ſome time, the ve
aſsume various kinds of diseased acti
producing different effects on the
Hence when the irritation and pain h
been great, the arteries are thrown into
kind of action, by which they secrete
which is deposited in different parts of
eye. As it is only the minute extrem
of the veſsels, that have this ſecre
power, and those on the *conjunctiva*,
the looseneſs of the cellular memb

that surrounds them, are easily expanded, any formation of matter is ſeldom found there. The matter is at times discharged into the anterior chamber of the aqueous humour, where, descending to the bottom, by its own weight, it has an appearance ſimilar to the white speck at the root of the nails, and has been called *onyx*. When the opthalmy is more violent, it not unfrequently happens, that the quantity of matter deposited in the anterior chamber, is ſo much more considerable, as almost to fill it, and then it takes the name of *hypopion* Indeed sometimes, the anterior chamber is filled with pus, which, going through the pupil, occupies also the posterior chamber, when, if not ſpeedily absorbed, it becomes inspiſsated, and remains fixed, forming adhesions to the capsule of the chrystalline lens, or the *iris*, which prevents vision: or else, suppuration having previously commenced in the *cornea*, it gives way, and the matter is discharged through its aperture, which is afterwards ſucceeded by the

loſs of the chrystalline and vitreous humous causing the coats of the eye to collapse But matter is more frequently deposited i the ſubstance of the *cornea* itself, than i any other part of the eye. If the increase action and ſensation are not very violent the veſsels in many parts of the *cornea* ſecrete a ſmall quantity of *pus*, which i deposited at their extremities, and is n ſufficient to produce a speck, but gives th eye a dull whitish muddy appearance which has been called *nebula*, or a cloud the pupil is scarcely visible through it, an objects are not distinguished by the patien The organization of the *cornea* is not muc injured by it, as on the inflammation ſubsi ing, the opacity is soon absorbed, and th ſight returns. When this peculiar actio of the veſsels is confined to one part, an matter is formed between the *laminæ* of th *cornea*, in ſuch a quantity as to ſepara them for any ſpace, a ſpeck or film is pr duced; the degree of the ill effects of whic will depend on its ſize and whether it

tuated near the external ſurface of the *ornea* or not. If the inflammation ſubsides efore the matter discharges itself, it often almost entirely absorbed, and, if on one de of the *cornea*, near the *ſclerotica*, the ght is not in the least injured; but when is on the centre, immediately before the upil, as there is usually ſome flight opacity emaining, from its ſtructure being injured, ision is not perfectly distinct. When the nickening of the *cornea* is towards the entre, and ſo great as to prevent the pas-ge of the rays of light to the *retina*, the ye will frequently accommodate itself to s imperfections, by turning on one ſide, hat the transparent part of the *cornea* may e opposed to the object, and more perfect ision be obtained. I once ſaw a person, hat had had an inflammation, ſucceeded y ſpecks in both eyes in ſucceſsion, ſome me intervening between each attack, and ho had obtained ſuch complete voluntary ower over the mucles of the eyes, that, e opacity being ſo ſituated as on directing

the axis of both the eyes, to one object, fig
was very imperfect, ſhe could turn eith
or both the eyes to or from the object, or
contrary directions, as ſhe pleased. Wh
the collection of matter is ſuperficial a
breaks; the contents of the abſeſs are di
charged and an ulcer is formed, which giv
the appearance of a ſmall hole or depre
sion: if very ſmall, it will ſometimes f
up and diſappear; but if more deep, it fr
quently leaves a flat opaque ſurface, whi
is a great impediment to the ſight, causi
objects to appear as if they were ſe
through glaſs, that had been made in wav
and whose ſurface is uneven. If the absc
ſhould be very large and deeply ſituat
in the ſubstance of the *cornea*, and bur
externally, ſuch a considerable ſupport
frequently taken away from that part
the *cornea*, that the remaining portion
no longer able to ſupport the action of t
muscles, but gives way, and as, when
the muscles act at the ſame time, they pr
the ſides of the eye nearer together a

wards, a part of the *iris* is protruded rough the wound in the *cornea*, forming ſmall black ſpot, which has been com-ared to the head of a common fly, and is oken of by authors under the name of *yocephalus*. If the protrusion is ſmall, ough the form of the pupil is changed to oblong, yet ſtill the *iris* retains its motion d the ſight is little injured: but if large, loses its power of contraction, and dila-n, and in ſome cases the edges, from ing inflamed and remaining ſome time contact, adhere, and the pupil is obli-rated.

If the increased action of the veſsels is nsiderable, yet not ſo great as to produce s, which, on account of the ſtructure of e part, cannot easily be formed, they go o another kind of diseased ſecretion, and w veſsels and parts are formed, or the old s elongated. Hence, at times, we find increase of cellular ſubstance to the *con-ctiva*, with a congeries of new veſsels,

which generally produce a prominent ridg
running from one of the angles towards t
centre of the *cornea*. At other times, wh
the inflammation has been violent and
ſome continuance, ſmall veſsels are to
ſeen on the external ſurface of the *corne*
in general there are not many, and th
course is from the edge of the *cornea* towa
its centre, in right lines. Though co
monly there are not more than from ſix
eight or ten of these veſsels, in ſome
whole *cornea* is ſurrounded with the
which have the appearance of *radii*, conv
ging to a centre; and, in ſome few cas
when the inflammation has been rather
vere, has ſeveral times a little ſubsided a
has again returned in quick ſucceſsion, t
diseased action has gone ſo far as to per
ate the whole body of the *cornea*, givin
the appearance of a highly vascular ſ
stance. To form these new veſsels, i
requisite that the circulation be not too mu
hurried, otherwise, instead of an accret
of new parts, *pus* only is ſecreted. T

peculiar action of the vefsels is not confined o the external furface of the eye alone. At imes it affects the *iris*, and fmall fpots or laments are projected from its circular dge, which have fomewhat the appearnce of the *iris* in a horse. If they continue o be fecreted, they extend themselves either ll they unite with the projecting memrane on the other fide, and thus form n opaque fubstance, which occupies the ircular aperture of the *iris*, and prevents ision; or else, they unite to the capsule f the chrystalline lens, by which the moon of the *iris* is impeded, and the fight endered very imperfect. It must be obrved, however, that in this latter case, e vefsels of the capsule of the chrystalline umour are previously affected with this ind of diseased action, which generally egins towards the centre, and if after the rojecting fibres from the *iris* have continued me time, the eye is carefully examined, will generally be found, there is a fmall paque spot on the centre of the capsule.

In a few weeks, and ſometimes even in few days, it it will be ſeen, that, the *i* has almost lost all motion, and that near edge on the capsule, there is a ſmall ci cular clear ring, through which, wh little ſight the patient has, must be obtai ed, as the middle is occupied by the whi opaque ſpot.

It ſometimes though more rarely happen that the chrystalline lens becomes opaq after a long and violent inflammation, mo especially if it has been the consequen of a blow on the eye; and occasionally tl action of the veſsels in the internal part the eye is ſo far diseased, as to change tl ſtructure of the vitreous humour or induce a paralysis of the *retina*.

The Causes *of* Opthalmy.

The ſame general causes, that excite in-
ammation in other parts of the body, will
roduce an opthalmy; but, on account of
e delicacy of the ſtructure of the eye,
nd its exposed ſituation, it is liable to be
ffected by ſo many things which, applied
other parts, would be innoxious, that it
wonderful inflammations of the eyes are
ot more frequent than they are: add to
hich, as an organ of ſense, it is ſtimulated
a manner peculiar to itself, by light and
olours.

Every ſymptom and appearance of the
sease, ſhew that the *impetus* of the blood
the veſsels of the part is increased, and
course any thing that can bring on a
onger and more frequent contraction of
e fibres, may produce inflammation. This
ay be done, either by the application of
ose ſubstances which ſtimulate the part

above the usual degree, causing an ov
exertion of the fibres; or by diminishing f
a time the usual *ſtimuli*, by which the ir
table principle in the part will be accum
lated, and the facility with which the fib
are excited into action increased; ſo th
great exertions will be produced by the
dinary *ſtimuli*, or by those a little ſtron
than usual.

It is not however to be ſupposed, that a
particular quantity of increased or dim
ished *ſtimulus* will produce an inflamm
tion of the eyes: that will depend on
general ſtate of the body, and the faci
with which its irritable principle is brou
into undue action, with the habitudes
fibres may have acquired of running i
diseased aſsociated motions, from a previ
inflammation; as those who are in a c
valescent ſtate, from an intermit
fever, will experience a relapse, from th
causes, which applied before the attac
the fever, would have been harmleſs:

those who have once been affected by *cynanche tonsillaris*, are very liable to a return of the ſame complaint.

But to know how, or in what manner inflammation is excited by the above means, it may perhaps be neceſſary to inquire into a few of the laws of life, which are connected with it.

All our motions, then, whether they are obedient to the will, or involuntary, together with the various orders of veſsels, which perform the different functions of the animal body, as thoſe of circulation, ſecretion, absorption, digestion, &c. whether irritative, or ſensative, perform their motions from *ſtimuli* of various kinds, applied to the different parts; but to produce this action or motion, it is requisite that there be, as well as the *ſtimulus*, a certain quantity of the irritable principle, or of that something which constitutes life, in opposition to inert matter, in each fibre.

This principle has been generally fu
posed to depend on a ſomething ſupplie
by the brain, though ſome modern phil
ſophers have attributed it to *oxygen*, obtai
ed by respiration, from the atmosphere; a
others have thought it might be explaine
on the ſuppoſition of the action of t
electric fluid; but what or which ever
may be, is in this place immaterial,
I only wish to point out the effects of c
tain causes, indifferent circumstances, wit
out venturing to inquire what these caus
may be; and the facts being acknowledge
whether the cause is considered, as t
effect of the irritable principle, which m
go under the name of vitality; or of irri
bility and ſensibility, as called by Hall
or of excitability, as called by Brown; or
the ſpirit of animation by Dr. Darwin;
of electricity by others, the facts, as a
stracted from the cauſe, will be ſtill
ſame.

As the health, and the regular perform-
ıce of the different functions of the body
lepend upon a certain equalization of the
ſtimuli applied and the quantity of the
:ritable principle, with the degree of tone
xisting in the moving fibre, when either
f these are in a greater proportion than
sual, the motions will become irregular
nd inordinate, and disease be the conse-
uence. Thus inflammation may be in-
uced, when the usual *ſtimuli* are increased
r a new one ſupperadded, the irritable
rinciple being in the natural quantity,
vith proper tone of the fibre, as happens by
ıe application of ſtimulant ſubstances; or
nflammation may be produced, when the
imulus is not greater than ordinary, but
ıe irritable principle increased or accumu-
ted, as takes place in going from a very
ark to a light place, or from eating the
sual quantity of food, after long abstinence.

Though it has been just remarked, that
:alth consists in the equalization of the

ſtimulus and the irritable principle; y either or each of these may be increased diminished in a certain proportion, witho disease, commonly ſo called, being indu ed, but merely a tendency or predispositi to it, which is liable to ſhow itself on a f farther increase of the *ſtimulus*, or of t irritable principle, which ever it happens be.

This may constitute the differences constitutions, or of what has been consider as temperaments. Thus in those peo whose ſupply of the irritable principl rather greater, than what health wo ſtrictly require, great ſtrength or tone the fibre is produced; the different functi are performed with great activity; the is hot and moist; the voluntary mot are executed with great facility and ſtren and their paſsions are ſtrong; digestio carried on with vigour, and the powe aſsimilation is great, and the alvine eva tions are not frequent or large in quan

This is the most desirable ſtate of existence, as the pleasurable ſensations are ſtrong, and the painful ones leſs frequent, than in any other: disease, also, though when it does come on, is generally violent and dangerous; yet it is difficult to be induced, as the system has, to ſome extent, the faculty of rendering harmleſs, thoſe things that would prove noxious, to many other perſons.

If a *ſtimulus* greater than natural is applied, unleſs it is attended with much pain, the parts are called into greater action, and the irritable principle is ſoon ſo much reduced as to put a ſtop to the undue exertions: or, being exposed to a *ſtimulus* leſs than natural, as cold; the great ſupply of the irritable principle, enables the body to prevent the acceſsion of that torpid ſtate of the veſsels, which those of a contrary constitution experience; one feels comfortable and pleasant, whilst the other is ſhuddering with cold. We might carry the comparison ſtill farther, and ſhew, that the

degree of cold that would destroy life i one, would be endured by the other wit impunity.

On the contrary, in those whose irritab lity is barely ſufficient to carry on the diff rent functions of the body, pleasantly ar regularly, as in those of a cool dry ſki whose ſtrength is exhausted by ſlight, ſhort exertion; of moderate paſsions, and, the appetite is good, whose alvine ev cuations are frequent, and the contrary ſtat or costiveneſs, prejudicial, causing hea aches and various unpleasant ſensations; t ſystem can but little accommodate itself trifling changes of the usual *ſtimuli*; for t fibre, being in a ſtate of atony or weakne and its mobility much increased, it is ve ſusceptible of any change of the usual *ſ muli*. If the body is exposed to a current air, which ſubstracts the heat quicker th common, or to an atmosphere cooler th usual, a torpor is immediately induced, a with it, an accumulation of the irritab

rinciple ſucceeded by irregular and diseased ction: this by repitition is more easily brought n, and if the deficiency of *ſtimulus* ſhould e greater than ordinary, and the torpor nger continued, inflammation will follow. Thus in those, who, in common language, re called ſcorbutic, whose hands, which are ost exposed to heat of different degrees, re dry and cold, and whose ſkins are ſubct to crack, occasioned by a want of ction, and atony in the cutaneous capillaries, om deficiency of the irritable principle; they regulate the external *ſtimulus* of eat, or ſo manage it, that the change ſhall ot be very ſudden, as, by wearing thick ather gloves, the ſkin of their hands ill continue whole; but let them go from warm room, into an air not ſo cold as to fect those of a contrary constitution, ſupose at 45 or 50 degrees of Farhenheit, the nds will become cold and pale, they ill then look rough and dry, and will entually crack. If one part of the hand more liable to torpor than the rest, which

often happens, and the cuticle is divide by putting a bit of oily adhefive plaist on it, which will confine the heat, a keep up the action of the vefsels, by t next, day the cracks will have disappear and the fkin be even fofter and clearer, th that of the neighbouring parts.

With respect to the effects of a greater lefs quantity of ftimulus on the living fib or the irritable principle, we cannot p haps fet the facts relating to it, in a clea point of view, than by considering action, at different degrees of ftrength, a ftimulus which is well known to ev one, and without whose presence, a certain proportion, life cannot exift: need I fay, that I mean the *ftimulus* caloric or heat.

When heat at a high temperature is plied to any part of the body, the *ftim* is fo very great, as to immediately ex guifh the life of the part, after which

ganization is completely destroyed; for, it generally happens in atmospheric air, decomposition takes place, forming ſome astic products, and a coaly or carbonacious sidium. When the *ſtimulus* of heat has ot been ſo great, or applied only for a ort time, the life of the muscular extre-ities of the capillaries is destroyed, ſtrong-and more frequent contractions of the ext fibres in ſucceſsion are produced, and ese exciting pain, act as a new *ſtimulus*, hich aſsiſts in increasing the action, and flammation is the consequence.

If the quantity of heat is rather leſs, the ganization of the capillaries is not de-royed, but the irritability is nearly ex-austed, and the effects of the application f the caloric will depend on the method f treating the part. If nothing is done to revent the ill consequence of the burn, he neighbouring fibres roused into exertion, ot only by the stimulus of an extra quan-ty of heat, but also by the disagreeable

ſensation arising from the injury done to t
capillaries, will be impelled into more f
quent contraction, which, producing pa
an increase of *ſtimulus*; and if not of t
irritable principle, at least of the activ
of it; and ſerum will be ſecreted, wh
will arise in the form of a blister. If,
the other hand, cold is applied, as by i
merging the part in cold water, it will ca
temporary eaſe, but the pain that follo
the withdrawing of the part from
water will be more acute, for the coldn
of the water prevents the fibres, alre
very much exhausted, from regaining th
natural proportion of the irritable princip
whilst the neighbouring parts ſuffer an
cumulation of it, and thus every ſympton
aggravated. But, on the contrary, if i
mediately after a ſlight burn, warm alcoh
or ſpirit of turpentine, (See Kentiſh
Burns,) be applied to the part, the first
of veſsels, having been previously ac
upon, by a much ſtronger *ſtimulus*, will
little affected, but the next order of veſ

ill be excited into action, and their irrit-
ble principle diminished, when the pain
ill ſubside, and in a few hours after-
ards, from the natural quantity of irrita-
lity being again accumulated, the healthy
tion of the part returns. When the
antity of heat applied is ſtill leſs, the
ntraction of the veſsels is increased, and
e part becomes ſlightly red; but as the
in is not ſo great as to cause much ſen-
ion, the pain ſoon ſubsides, and the
althy motions return.

Our next degree of heat is what we are
ways exposed to, from the caloric in the
nosphere, under which, when moderate,
l the functions of the body are pleasantly
d regularly performed; but as it is liable
librations, being often in England, at one
ne of the year, ſixty degrees hotter or
lder than at another, according to the
ntinuance of the greater, or leſs degree
heat than usual, or the rapidity of its
anges, the body is liable to be affected in

different ways, and by diseases under
ferent forms. Diseases too are more frequ
when the daily viciſsitudes of heat are
siderable, as in hot days and cool eveni
or when the atmosphere is loaded
moisture, which, by causing the air to
much better conductor of heat, ſubstrac
from our bodies quicker than ordinary,
clearly perceived in going from a
ventilated room, into which the ſun has
free admiſsion, or where there has
been a fire, into one no colder, as indic
by the thermometer, but into which,
air, and the light have not been abl
enter, and whose walls are damp, an
atmoſphere of courſe, ſaturated with
ture.

Man is able to exist under very diff
degrees of heat; yet the parts of his
are ſo fashioned, as to render him u
to bear the fervid heat of the equatori
gions, with impunity: for heat, o
body being continually exposed to it, a

certain quantity, is inimical to the dur-
ion of life. It is difficult to judge what
recise time, the omnipotent Director of the
niverse ordained, that man ſhould remain
n this little ſpeck of the creation; but
ertain it is, that life is protracted to the
eatest length in the temperate zones.

It has already been ſaid, that life consists
the application and preſence of a certain
uantity of *ſtimulus* and of the irritable
inciple, and it may here be added, that
eath will follow, when either of them are
eficient in a certain degree. It may
erefore be easily inferred, that the more
e *ſtimulus*, or the irritable principle has
een increased from birth, to carry on the
nimal functions, the ſooner vitality will be
xtinguished. Thus between the tropics,
e *ſtimulus* of the ſolar heat is the greateſt,
d the motions of the body are performed
ith more ſtrength and celerity, in the early
ars of life; by the warmth of the climate
berty ſooner arrives, ſucceeded by a pre-

mature and early old age, and in forty fifty years they die. In these, the fil having been previously much exerted fr the undue *ſtimnlus*, more ſpeedily lose power of being acted on by it, and ani tion becomes extinct.

This premature death is not induced caloric only, but by every other ſtimu The potation of much ſpirituous liqu the ſwallowing of large quantities opium, or great voluntary and contin exertions, will produce the ſame ef Hence the life of dram-drinkers is ſhor ed, of those of the Mahomedan faith, w being prohibited wine, make free opium, and of the hard working and l rious mechanic.

In this temperate climate, we all l experienced the debilitating effects of a ſummer's day. The circulation is incre by it, both in frequency and force; the is hot and bathed in ſweat, by the

ction of the capillaries, and, by noon, the whole body becomes languid and feeble, from the rapid expenditure of the irritable principle. On the contrary, the tonic power of cold, has been much ſpoken of, and highly commended by Physicians, but being only a negative quality, it acts, only, by its not allowing the irritable principle to be ſo quickly expended, and the moving fibre weakened.

The effects of a certain degree of cold will be different, on different constitutions: one, from a temporary diminution of the activity of the circulation, will feel invigorated; whilst another, from a torpor being induced, followed by an increase of the contraction of the fibres, ſtronger than their degree of vigour can endure, will be unfeebled and languid.

As we descend in the ſcale of heat and arrive at about the temperature at which water freezes, on the body being ex-

posed to its influence, a temporary quie
cence of the capillaries of the ſkin
brought on, and the pulsation of the arteri
becomes ſlower; but when the muscul
fibres have acquired a certain increase
the irritable principle, the diminish
ſtimulus is ſufficient to excite them in
action, and if the quiescence has been gr
or long continued, ſtrong contractions ta
place, as in the burning ſensations we f
on coming into the house after riding
horse back in frosty weather, or a
handling ſnow, which causes what is call
the hot-ache.

If on torpor being present, the us
quantity of *ſtimulus* or a greater one
applied, the exertions become ſo great,
to bring on inflammation, as in those wh
fingers being benumbed with cold,
them ſuddenly near the fire to warm th
which produces a *paronychia*: or in th
who are forst bitten, and have heat
ſuddenly applied to their bodies. If

cold is ſtill greater, ſuch a degree of quiescence takes place, as to put a ſtop to all action, and a ſucceeding *ſtimulus* is applied in vain, and the death either of a part, or of the whole body follows.

We cannot carry our inquiries reſpecting the effects of a very great degree of cold, or rather of a very ſmall quantity of heat, ſo far as we can of caloric at a high temperature: but we are told, that on ſome of the French Philosophers making experiments with ice and different mixtures to freeze Mercury, that, on one of them putting his finger for a few ſeconds, into the compound, which was ſome degrees below o, it gave him an acute pain, as if pins, or ſharp bodies were piercing his flesh.

I have been rather more prolix, in laying down the doctrine of the effect of the increase of *ſtimuli*, or of the irritable principle, than might perhaps, at the first view, appear neceſſary in a treatise on opthalmy;

but as my plan of cure will a good dea depend on what has been just ſaid, I coul not with propriety ſay leſs, to make m ideas on the ſubject ſufficiently clear, an indeed, as we proceed, I ſhall have occasio to touch on it again.

Inflammations of the eyes then may l caused, either by an increase of the usu *ſtimuli*, or of a new one ſuperadded;

Or, by an increase or accumulation the irritable principle. But to be more p ticular:

First, Inflammation may be excited, any thing which can ſtimulate the veſs of the eye into actions greater than natur as,

A. By violence done to the eye by m chanical means, which ſeem to prod their effect, from the form and ſolidit the particles, destroying the continuit

ne part, or from its motion being impeded, s, blows or wounds in the eye; warts, or ncysted tumors, on the lids; an inversion f the ciliary edge of the eye lids; or by reign bodies inserted between the lids nd the globe.

B. By ſtimulant and acrid ſubstances.

C. By those things which affect the eye, s an organ of ſense.

D. By any thing that will increase the ction of the lachrymal gland, which by using a more copious ſecretion of tears, ill add to the irritation, and particularly they are confined, as in the measles, ſmall ox, &c.

E. By the action of the veſsels in the cinity being increased, as by erysipelatous, nd various inflammatory affections of the ce; and wounds, or burns, of the ſame rt.

2. By a *ſtimulus* leſs than natural, as cold, ‡ as by going from a warm room i cold air.

Having mentioned, in general ter those things that will produce inflam tion of the eyes, we ſhall proceed to ſp of each in detail, and first:

1. Blows on the eye, according to force with which they are given, or greater or leſs mobility of the ſystem, or o part, may bring on very different deg of inflammation. If ſlight, the effects most commonly of ſhort duration, b violent, a confusion of the coats and mours takes place, which produces a curable blindneſs.

‡ Though cold is mentioned here, as well as in other places, as a peculiar ſubstance; the reader will re that it is meant only to ſignify a ſmaller quantity o than is comfortable to the feelings, or the ſudden ſubst of a portion of heat, when it is applied in a greater de

After blows given by the hand closed, or
ny obtuse body, though little inflammation
ould follow, and only ſlight injury ſeem
xternally to be done to the eye, yet in a
w hours, perfect blindneſs may come
n; but in general, it is after ſeveral days
ave elapſed. On inſpecting the eye, it
ill uſually be found that the *iris* is mo-
onleſs, and dilated rather more than the
und eye, and that the chrystalline
umour is ſlightly opaque; yet in ſo ſmall
degree as to render it little more than
isible, and often pushed a little on one ſide.
he lens generally continues getting more
paque, till it puts on the usual appearance
f the cataract, and after ſome months, the
otion of the *iris*, with the ſenſibility of
e *retina* often returns. In these cases,
lindneſs is caused in the first instance, by
e insensibility of the optic nerve, as the
ight muddineſs of the lens, cannot ſuf-
ciently account for the want of vision: and
fterwards by the opacity of the lens; for
he violence of the blow, producing ſome

change in the ſmall transparent veſsels of
lens, they ſtill carry on their diseased act
whilst the ſensibility of the retina flo
returns.

A ſudden blow, being given to the
with a ſmall blunt body, and probably
peculiar direction, and with a certain f
will ſometimes burst the capsule of
chrystalline lens, and force the body o
lens, through the *iris*, into the ant
chamber. About five years ſince, a
was brought to me, who was ſtruck o
eye, with a piece of ſteel, that flew o
tool, he was hammering. On inspecti
found, on the outer ſide of the eye,
midway between the circumference o
cornea and the outer angle, a ſmall e
vasation of blood on the *tunica conjun*
which in other respects appeared to
good deal injured by the blow, an
chrystalline lens, was ſeen about hal
truded through the aperture in the *iris*
the anterior chamber, of the aqueou

hour: the *iris* alſo in one part was ſlightly
cerated. On the next day, the whole of
he lens was discovered to be in the an-
rior chamber, and which became opaque
hree days after the accident. He recovered
om the ſubsequent inflammation, as ſoon
s could be reasonably expected, and though
is five years ſince, the ſize of the lens is
ot apparently diminished, and in that time,
e has only had one attack of inflamma-
on, ſo violent as to prevent him from
ttending to his usual employ, though it is
requently ſlightly red and irritable.

A few weeks ſince, alſo, a man wished
my advice, for an inflammation, attended
vith a good deal of pain, which he had
n one eye. On examining the eye, I ſaw,
o my ſurprise, that the chrystalline lens,
which appeared of the natural ſize, occupi-
ed almost the whole of the anterior cham-
ber, yet not ſo much ſo, but that the *iris*
could be perceived to have preſerved its
proper figure, and looking at the eye in

one direction, I thought I could perce
an opacity of the capsule of the lens.
my inquiring into the history of his c
plaint, he told me, that more than *tw*
two years ago, as he was digging in a di
a twig ſtruck him with considerable fo
on the eye; that he could ſee a little a
the accident, but that by the next d
the eye became very painful and ſwel
and that on the inflammation ſubsiding
found he had totally lost the ſight of
eye. In a few weeks, the eye became
from pain, and from that time to this las
tack, which he attributes to cold, and w
is a period of 22 years, he ſays it has n
prevented him from attending to busi
though he recollected, on my questio
him, that two or three times, the eye
been ſlightly red and troubleſome, f
few days.

We learn from these cases, that
chrystalline lens is not easily abſor
when deprived of its capsule; and th

ay remain in the eye, and act as an ex-
aneous ſubstance for many years, without
using much irritation. Hence it is very
robable, that in depreſsing the cataract, the
ens is not absorbed, as is generally ſuppos-
d, but lies buried in the vitreous humour,
nd as it does not produce much irritation,
hen ſituated in the anterior chamber of
he aqueous humour, where it must, in
me degree, preſs upon the irritable *iris*,
is not likely to do ſo, when concealed in
he vitreous humour.

2. The danger attending wounds and
unctures, is ſtill more formidable. A
word or knife, dividing the coats of the
ye, causes an evacuation of the humours,
ucceeded by total and irreparable blind-
eſs. If the instrument is pushed with
uch violence, it may pierce through the
lobe, fracture the thin bones at the bottom
f the orbit, and penetrate the brain itſelf.
uch wounds are frequently followed, by
he most dreadful head-aches, large ab-

sceſses following the inflammation, anc
the brain is compreſsed, immediate deat

If the wound is inflicted by a needl
any ſmall ſharp instrument, the dar
will depend on the depth and directio
the puncture. When the instrument
merely pierced the *cornea*, without ei
touching the *iris* or the chrystalline l
the wound usually heals in a few d
with a moderate inflammation, lea
a ſmall opacity, which when not
wards the centre of the *cornea*, gives l
inconvenience: but if, unfortunately,
penetrates, or even touches, the chrystal
lens, although at first, the ſight ſhould
be much impaired, it is greatly to be fea
that it will be affected in a week or two,
produce one ſpecies of cataract which
obstruct the rays of light in their paſ
to the retina, and prevent vision.

If, by the wound, the *iris* is divided o
cornea penetrated very near where i

ned to the *tunica ſclerotica*, part of the is frequently protruded through the erture, and forms one ſpecies of the *philoma*. In that caſe, the figure of the pil is changed, from a circular to an oval, ſome other irregular form; but if the trusion is ſmall, the part of the *iris* hich is not displaced preserves its power contracting and dilating, and the ſight, er the ſubsiding of the inflammation, is as rfect as before. If the protrusion has been eater, it forms a large irregular projecting bstance, which, by rubbing against the s, adds much to the irritation, and in nsequence, the inflammation is much inreased, which frequently produces adhenns of the *iris*, with loſs of motion, a ickening of the *cornea* or of the chrystalline ns, that is ſucceeded by an incurable ndneſs.

Wounds made through the *tunica ſclero-a* and *choroides* must either enter the rystalline lens, causing an opacity of it,

or if it goes more inwards, will injure
retina, and produce a confirmed *gutta ſer*
with immobility and a dilation of the
Wounds, therefore, that are made in
ſclerotica are always hazardous, and
danger is increased, according to the n
nitude of the ſolution of continuity, an
distance from the *cornea transparens*.

An extravasation of blood, under
tunica conjunctiva, is frequently prod
by blows on the eye, as well as by punc
and ſmall wounds, from ſome ſmall a
or arteries being divided, which ca
pour out their contents externally.
quantity of blood thus extravasated
ſometimes ſo considerable as to el
the whole *conjunctiva* above the co
in the ſame manner as in the *chem*
but in general the quantity is much ſma
only forming an irregular red ſpot or
round the mouth of the veſsel, and
the eye has been otherwiſe injured, th
the red ſpot ſhould be considerable,

n will be experienced, and the ſight l not be at all affected. Abſorption often s on ſlowly, and the blood is ſeveral eks in disappearing, to the great uneasi- s of the patient; the *ſerum* is first ab- bed, and the blood becomes darker co- red, and almost livid; it then gradually nges, and goes through all the inter- diate ſhades of colour, from a very dark a greenish yellow hue, and thence to its ural appearance.

. Warts and encysted tumours of differ- kinds, ſituated on the lids, are frequently cause of inflammation. Some people, more especially children, have repeated ps of warts on the lids, that are commonly ated towards the edge of them; and ich, by their irritation, induce inflamma- n. The tumours that are met with on lids are various in their ſize, and in the earance of their contents, and on that ount have had different names given to m by authors. They are at times of a

conſiderable ſize; and when they hap
to be on the upper lid, by the impedir
that arises to its free motion, and the p
sure which they make on the eye, the
often a great ſource of inconvenience.
tumours for the most part are moveable,
contain a matter of different degrees of
sistence, from a glairy gelatinous like
stance, ſomewhat ſimilar to the white
egg, to one as thick and as firm as fu
cheese.

Nearly allied to the encysted tur
above-mentioned are those ſmall inflar
tory tumours, which ſpeedily termina
ſuppuration: they are frequently forme
wards the edge of the lids, and are comm
called Styes, Stians, or Pouks. The
often productive of a temporary inflar
tion; but as they usually ſuppurate in
or four days, it is ſeldom of any long
tinuance, unleſs the eye, from previou
ease, is more inclined to run into dis
actions. When matter is fully form

iem, they may be opened with the point a lancet; or if the tumour ſhould be ſitu-ed on the edge of the lid, it will often be fficient to extract two or three of the eye-shes, whose roots penetrating its body, on ing removed, will afford an opportunity r the evacuation of the matter.

4. An inversion of the edges of the eye-ls, called by authors *Trichiasis*, is at times other cause of Opthalmy. This, from e continual irritation produced by the bbing of the hairs againſt the eye, causes inflammation, which, if the inversion is t ſoon removed, will be productive of a od deal of mischief. The diſorder nerally comes on in a gradual manner, l unleſs, at its commencement, or joined th ſome other cause of inflammation, n gives no violent pain; but an un-sing irritation, with a constant flow of rs, on the motion of the lids. Many of veſsels of the *conjunctiva* are enlarged, l there is either an accretion of new

veſsels on the *cornea*, or a general opacity it; and as both those diseased appearanc are often abſorbed, on the cause being moved, we ſometimes ſee those that ha been blind for months, on the inversion ing cured, have in a ſhort time recove their ſight.

A preternatural or a double row of hai ſometimes formed, and again at other tir either the hairs are placed irregularly the ciliary edge, or there are only a ſupernumerary ones; these, by rub against the eye, cause inflammation in ſame manner as the *trichiasis*.

5. Extraneous bodies inserted betw the lids are not an unfrequent caus opthalmy. The irritation they excit the part in which they are fixed, and hard and uneven ſurfaces, rubbing ag the opposite part, on the least m of the eye, or the lids, produce pain, with an inability to repeat the m

the lids, ſucceeded by a violent and angerous inflammation, more especially if e extraneous bodies, besides the irritation om their bulk and hardneſs, poſseſs any imulant qualities, as lime.

6. There are a variety of ſubstances, hich ſtimulate the fibres into undue exer- on exciting inflammation, whose effects nnot be accounted for, from the general ws of matter, as far as relate to their ſize, ardneſs or ſhape, but are owing to certain mbinations, which produce ſuch motions the living ſystem, that the knowledge their component parts, would not lead to ſuppose probable: these may be called emical causes of inflammation, ſuch are e application to the eye of eſsential oils, ids, or acid vapours, alkalies, and the fferent compounds, in which either an kali or an acid is an ingredient, acrid ices, and that univerſal and diffused *imulant*, caloric.

7. There are others which act on t
eye as an organ of ſense only, whose i
mulant effects are peculiar to the *retina*;
much light, particularly after the ſensibil
of the optic nerve is increased, from co
finement in a dark place; exposing the e
for ſome time to ſnow, whose excitt
power is much increased by a clear ſky
ſun ſhine; the eye being long fixed
vivid and bright colours.

8. Inflammation in many instances
brought on by the increase of the actio
the lachrymal gland, causing a gre
flow of tears, whose ſaltneſs or acrimo
ſeems to depend on the ſtronger exer
of the ſecreting veſsels, as is ſeen in m
weeping from mental affections.

The probability of inflammation b
induced, is increased if, with the gre
flow of tears, the neighbouring parts ar
flamed, as in the measles, when the r
the eye-lids, and the parts adjoining,

ven the whole face are generally ſwelled nd inflamed; and indeed inflammations the eyes are very common, immediately evious to or during their eruption, which ten continue for ſome time, causing ſmall cers and opacities of the *cornea*. As the uption of the measles disappear, the redeſs of the eyes generally ſubsides, though om the action of the veſsels being increasd, during ſome days, and the mobility of e ſystem being greater than usual, the eſsels are extremely liable to run again into iseased motions on the application of a reater or leſs degree of heat, than common, nd often, for months, the most trival varitions of heat and cold, will excite a temorary inflammation, which at times is conerted into a very obstinate and painful isorder.

The bad effects arising from an increased ſeretion of tears, will no doubt be much aggravated, if, with the inflammation of the lids, hey ſhould be ſo much ſwelled as to pre-

vent their being opened, which happ
in the ſmall pox. In that disease the e
lids are frequently tumefied and firm
closed for ſeveral days, and from the confi
ment of the acrid tears, the most dread
conſequences follow. On the eye-lids
ing again ſeparated, the *conjunctiva* is
quently found highly inflamed, and
cornea transparens ulcerated. If the *cor*
ſhould be unaffected and the redneſs of
conjunctiva ſoon disappear, the eyes will
ſome time be liable to a recurrence of
inflammation, from trivial causes, the ſa
as has been mentioned to happen, after
measles.

It is generally ſupposed that those o
cities of the *cornea*, which ſometimes att
the ſmall pox, are the consequence o
pustule or pustules being formed there;
judging *à priori*, we might naturally c
jecture, that when the face is entirely cove
with the eruption, it would be probable
external ſurface of the eye would not esca

very ſeldom, however, happens, that any
stule is found on the *tunica conjunctiva*;
d though I have attended particularly to
at ſubject, I have never been able to de-
t what I could call a ſmall pock pustule
the *cornea*. It is true, on the opening of
e eye there is ſeen, occasionally, on the
nea, a vesicle, filled with an opaque
atter, which has a good deal the appear-
ce of a ſmall pock pustule, but instead of
ing off like the other pustules, it continues,
is absorbed the ſame as a common col-
tion of matter from an ordinary inflam-
ation; besides, it is never ſeen with the
mmencement of the eruption of the face,
t only after the lids have been closed for
veral days, which makes it probable that it
the consequence of the confinement of the
rid tears, with the consequent inflamma-
n.

Whence is it that pustules are ſo ſeldom
rmed on the arterior ſurface of the eye?
o the veſsels with difficulty run into

that kind of diseased action, from ſo
peculiar ſtructure of the part; or can
peculiar action of the veſsels be prevent
from the eye being always kept moist;
a considerable cooling proceſs almost c
stantly going on, by the continual evap
tion. We cannot easily inform oursel
of the heat of the eye, in its natural ſt
but in those animals who have a moist
face, exposed to the air, as the noses of
and dogs, on touching them, they gener
give us the ſensation of coldneſs.
know that the quantity of pustules proc
ed depends in a great degree on the ſ
of the body, with respect to heat; he
the eruption is thickest on those parts
are covered with plasters, and the g
effects of moderating the heat of the b
is univerſally allowed.

Under the ſame head of an incre
ſecretion of tears, or of their confinemen
the eye as a cause of Opthalmy, may be
cluded the *fistula lachrymalis*. This

se, ſo named from a mistaken idea, that e ancient physicians had formed of its ture, cannot with propriety be called a *ula lachrymalis*, unleſs in the very ad- nced ſtages of it. It is caused by an ob- uction of the lachrymal canal, which nveys the tears from the eye to the nose, er having performed their office of moist- ing the eye, and by that means keeping e *cornea* transparent. On the paſsage of tears into the nose being obstructed, the *cus lachrymalis* becomes distended, and e tears, instead of being absorbed by the *ncta lachrymalia*, remain in the eye, con- ed by the lower lid, till they are collect- in ſuch a quantity, as to run over the iary edge, and down the cheek: these oving a ſource of irritation by their long ntinuance in the eye, as well as by their mulating effect on the lachrymal gland, using a greater ſecretion of tears, excite flammation.

9. Inflammation of the eyes may alſ
brought on by any thing that causes m
inflammation of the face, as various erys
latous affections, particularly that ſpe
which is called St. Anthony's fire, o
burns or wounds, in the vicinity of the

Having gone through the different ca
which produce inflammation of the e
by directly stimulating the veſsels
greater action, I ſhall proceed to
ſecond division, in which, inflammatic
induced by the ſubstraction of the u
ſtimuli for a time, and then from the ſuc
application of it again, in the nat
quantity or perhaps rather greater thar
dinary. This, by allowing an accumla
of the irritable principle, ultimately br
on inordinate and diseased action.
principle of irritability is generally
fused pretty equally through the fibre
our whole ſystem, and, unleſs excite
ſome particular part, by great pleasur
pain, tends to an equilibrium; but in t

scles whose motions are involuntary, the
ply of the irritable principle having been
stant and perpetual from birth, their
on being necessary to existence, though
usual *stimulus*, and, of course, their exer-
is diminished, still they have their
ustomed supply of this principle, which
omes accumulated, either, till the
ural quantity of *stimulus* is re-applied,
until the accumulation is so great as to
der the part susceptible to be acted on
the smaller *stimulus*. (See Darwin's
nomia).

The same laws with respect to the accu-
lation and exhaustion of the irritable
ciple, is observed in the inferior animals,
is extended also to the vegetable tribe.
llanzani remarks, that in the autumn
vts bury themselves and become torpid;
en the thermometer is at 54, and that,
ing the winter, they regain their irrita-
ty and re-appear in the spring, when the
rmometer, is considerably below 54:

and, he obſerved, that when in ſprin
exposed the vipers that were torpid to
heat of 67 degrees only they died, tho
during ſummer, they bear a much gr
degree of heat without the least in
Vegetables ſleep in winter, and are awa
ed by the vernal ſun ; but die if a too po
ful heat be ſuddenly applied, from thei
cumulation of irritability.

The voluntary muſcles, or those of
motion, have, from habit, acquired a
facility by voluntarity, either of dire
the irritable principle to or exciting it in
tain fibres, in preference to others. Neve
leſs, it is not to be ſupposed that it is eve
paſsive ſtate in them, as aſserted by
authors : though not ſupplied in that qua
as in the involuntary muscles, it is in cor
action, as is seen in the tremor of old
in the palsy of the head ; and from the
traction of antagonist muscles, when
which counterpoise them are cut thr
or lose their action, (called by Halle

insita), from a paralytic affection. It is able that this voluntarity is a good deal uired by habit, from the extreme awk-dneſs of an infant learning to walk, and muscles, from frequent use, acquiring ngth, or more properly ſpeaking, from r obtaining the power of directing or ex-ng a large quantity of the irritable prin-e in a given time to certain muscular s. It would appear, too, from the almost ſsant motions of young animals as of dren, who, unleſs asleep, are in almost stant action, or in the play of puppies kittens, that in the earliest period of existence it was more constantly and larly diffused over the whole ſystem.

Though an exceſs or defect of the accus-ed *ſtimuli* produces a temporary qui-ence of the part, yet as the causes are lly different, ſo are their effects. In the t case the torpor is induced by the *ſtimulus* iting the muscular fibres into greater ion than natural, which expends the

irritable principle faster than it ca
generated, and by that means diminiſh
power of being excited, and renders th
incapable of carrying on its usual motion
leſs by the application of a ſtronger ex
cause. On the withdrawing of the ſtr
ſtimulus, the ordinary ones do not pr
their accustomed effects till the irri
principle is again collected in its uſual
tity; when the motions of the part pr
as before.

On the contrary, in the quiescenc
duced by the deficiency of *ſtimulus*,
is an accumulation of the irritable
ciple, which is called into exertio
a *ſtimulus* leſs than natural, which
once brought into action, the fibres a
cited into ſuch ſtrong contractions
cause pain, which acts as a powerfu
mulus, and if violent, or long conti
exhausts the irritable fibre, and in
torpor: the irritable principle is
gradually collected, the parts are obe

their ordinary *ſtimuli*, and their motions e performed as usual and health returns.

This desirable termination however does t always happen, for on the ſudden ap- ication of the natural *ſtimulus*, when the itable principle is much accumulated; as those who have been long without food, who have been exposed to much cold, flammation will ſucceed: this will arise e more easily, if, from previous disease, e fibres are easily excited into inordinate d irregular exertions from aſsociated tions.

From what has been ſaid, it may be in- rred, that the irritable principle with re- ect to the moving fibre may be in three fferent ſtates:

1*ſt*. When the expenditure by the action *ſtimuli* is equal to its ſupply, it may then ſaid to be in a ſtate of *Tone*.

2*d*. When the expenditure exceeds ſupply of this principle to the fibre, it n be ſaid to be in a ſtate of *Exhauſtion*.

3*d*. But if the ſupply of the irrita principle given to the moving fibre, exce the expenditure, it may then be ſaid to in a ſtate of *Accumulation*.

A deficiency of *ſtimulus*, is by far most common cause of opthalmy. On application of any ſtimulant ſubstance, pain that it induces immediately wa us of the danger, and we hasten to rem it; which being done, the very cause induced the increased action, and wh would continue it, is taken away, and contractions directly begin to diminish.

If the heat of the atmosphere is increa which is the *ſtimulus*, we are most expo to, on its being again brought to its dinary ſtandard, no inflammation follo but the force of the contractions gradu

ase and the healthy action returns. No ditional thing can be applied to the eye, dependent of its relative degree of heat d cold, but what will act as a *ſtimulus*, d on that account, in considering those uses that will diminish action, we must ally exclude all ſubstances, to which the es are not usually exposed.

The eyes are exposed to the *ſtimulus* of the ars, of the blood, of the air, of light, and heat. An alteration, in the usual ſecre-n of the tears, may increase, but cannot minish their ſtimulating effect; the blood, cording to its quantity or quality, may ve its exciting effects, either increased or minished, but as that will act as a general use on the ſystem, it cannot properly be roduced here; the atmospheric air also, it is ſupposed, from the experiments of . Beddoes, to owe its ſtimulating power the *oxygen*, that is one of its constituent rts, the proportion of which, is ſubject to ry ſlight variations, cannot be thought

to differ much in its effects on the eye different times, and the absence of lig during the healthy ſtate of the eye, does appear to diminish the action of the veſs though in an inflamed or irritable ſtate produces a considerable effect on the there is only one cause then, to which can attribute the diminution of the *ſtimu* and the decrease of action, which is loric.

The quantity of heat to which we exposed is varying every minute, and often change in a few hours, more t thirty degrees; this changeableneſs greater, from the inventions of civili life, from hot rooms, and partial clothi and the exposed and uncovered ſtate of eyes, whilst other parts of the body defended by ſubstances, which trans heat ſlowly, make them more liable to affected.

Vhether heat is applied to the eye above
nder the usual degree, previous to in-
mation, a topor will be induced which
be more likely to happen, when the
ge is ſudden; as in going from a warm
n into the night air, but as, at the time
dom occasions any unpleasant ſymptom,
disregarded till the ſubsequent reac-
takes place.

t in most instances there is a predis-
ion to the disease, and though the
r at first may be ſmall, and the re-
n also not great, yet it may be ſufficient
roduce another ſtate of quieſcence,
r more considerable than the first,
h again produces an accumulation of
ritable principle, and the accumula-
and exhaustion, continue alternately
me on, till a violent disease is formed.

treating on the causes, which ge-
ly produce Opthalmies, it may perhaps
ought neceſsary, that ſomething ſhould

be ſaid respecting *ſcrophula*, and *ſy*
as they are considered, by medical w
on the ſubject, as often the causes
flammation of the eyes. It is very
mon to ſee those, who have evident
of a ſcrophulous habit, affected
Opthalmy; and when once it comes
is in general, not only a long time i
siding, but very liable to return from
changes in the quantity of the or
ſtimuli, and particularly from variat
the atmosphere. I conceive that *ſcr*
cannot be ſaid with propriety to
cause of Opthalmy, but merely rend
part of the ſystem more ſusceptible
action of any exciting causes, to whi
exposed, from its inability of r
noxious powers, and its not being
accommodate itſelf to ſmall changes

The *ſcrophula*, according to Dr.
depends on a *peculiar* constitution
lymphatic ſystem; that, however,
vancing but little towards arriving

rate idea of the disease. May we not clude that this peculiar constitution is ng to a want of energy or activity in the le ſyſtem, but particularly of the ab- ents? That it depends a good deal on deficiency of vigour of the whole body, ears, from those causes that tend to pro- it, having a debilitating effect; as ng in low, moist, and confined ſituations, mmatory diseases, ſmall pox, poor diet, t of pure air and exercise; and that eral weakneſs and want of energy are ent, is probable from the cold extremi- the frequency in the winter of chilblains e hands, and kibed heels; from injuries atening the body being feebly resisted, from the ſlow recovery of the con- tion from disease. That there is a de- ncy of irritability, or want of energy in absorbents, in those that are predis- d to *ſcrophula*, appears from the moist , from the difficulty with which ulcers , on account of the want of power of lymphatics to absorb the fluid ſecreted

by the capillaries, causing the dischar
an acrimonious fluid.

Concluding, that in ſcrophulous h
there is a deficiency of activity in
ſystem in general, and of the absorbe
particular, it will easily be unders
that if there ſhould be an accumulation
irritable principle, from defect of *ſtim*
as from cold; on the increase of exe
ſucceeding to the torpor, the cutaneou
ſorbents may take up a greater quant
fluid than usual, and this increased act
not extending to the next order o
ſorbent veſsels, beginning at the gl
they may be ſupplied with more tha
can absorb, and an accumulation of l
may be produced, causing an enlarg
of the gland, and in the end, inflamm
from the want of energy, too, the ſys
rendered more ſusceptible of being af
by any irregularity in the usual *ſt*
thus they are ſubject to *phthisis pulmo*
cynanche tonsillaris, catarrh, and opthal

d in those disorders it will be recollect-
, that the parts affected are not only
ily excited into action, but are also par-
ularly exposed to the ſudden changes in
e heat of the medium that ſurrounds us.

When the ordinary *ſtimuli*, as heat and
ld, food, &c. are uniformly and regularly
plied, the different functions of the body
e performed properly; and the ſecretions
d abſorptions are equal; but as from the
ficiency of ſtrength of the muscular
res, a torpor of the extreme veſsels is
ily induced, their actions must fre-
ently be irregular, and this often recur-
g, it is not wonderful that ſo delicate a
rt as the eye, and which is ſo much expos-
, ſhould in our earlier years be affected
ith inflammation, which, when once
ought on, is, from aſsociation, much more
kely to return on the ſame irregular action
ain taking place. It will in general be
und, that the more delicate and fair the
in is, the more ſusceptible they are of
iseased motions.

On examining the inflamed eyes of tho who have ſigns of *ſcrophula*, as fair ſkin ſwelled over-lips, and ſome of the glan of the neck enlarged, there is ſeldom general increase of action of the veſsels the *conjunctiva:* there are veſsels to ſeen larger than natural over the whc ſurface, but the white colour of the *tun albuginea*, is visible between them, nea of its usual appearance; much light gi pain, causing a plentiful effusion of tea and when the disease has continued fo time, the ciliary edges of the eye-lids often affected; ſome of the hairs come and the ſmall ſebaceous glands, *glandul Meibomii*, are inflamed, and at tin ulcerated, causing the Psoropthalmy of M Ware.

It has been ſupposed that these ſm glands are diseased on account of that t dency of enlargement, and inflammatior the glands in *ſcrophula*; but I think it n be better accounted for, from the great f

bility of ſcrophulous habits, and the equent and almost inceſsent discharge of ot acrid tears, over the edge of the eye-ds, which are often ſo acrimonious as to coriate the cheek. When these glands ave once acquired this diseased action, it more easily repeated, and eventually ght causes will bring it on, and they ay be a good deal inflamed when little creased action is to be ſeen in the eye. would be paying an ill compliment to a ne complexion, to ſay, that all those who ave fair ſkins, have a tendency to *ſcrophula*; may, however, venture to aſsert, that the ore delicate the ſkin of my patient, the ore tedious is the cure of the Opthalmy, nd the more liable it is to return from ight causes.

This rule, I need not ſay, will not hold ood inversely, for there is another disease at people with dark complexions are bject to, which will now be ſlightly uched on.

The disease alluded to, as far as I c
recollect, has not been accurately defir
by medical writers. In common a
familiar language, it is called ſcorbu
though it does not ſeem to have any c
nection with the *ſcorbutus* of nosologi
It appears to be a debility, and w
of action in the cutaneous veſsels, a
is marked by a dry and harsh ſk
little or no colour in the cheeks,
cuticle by places coming off in powder,
in ſcales; when the ſkin is abraded it
long time in healing, eruptions in diffe
parts of the body are common, especi
in those that are most exposed, as the f
and hands, ſometimes in ſmall red pim
which ſuppurate, at others, ſmall vesicati
filled with a transparent fluid arise, atte
ed with an itching and burning; t
break, and are ſucceeded by others, an
this manner it will occasionally conti
for months, causing much pain and une
neſs. People of this constitution ſlowly
cover from inflammations of the eyes,
is ſeldom attended with much pain, un

for a few days at the commencement of the disorder; and though the vessels of the *conjunctiva* shall be a good deal enlarged, the light causes little inconvenience. A discharge of adhesive matter from the lids also, is frequent, part of the eye lashes fall off, and the glands ulcerate; indeed sometimes, after the inflammation has repeatedly recurred; it is entirely confined to the lids.

From the cutaneous vessels having less energy of action than usual, some degree of torpor will take place from a *stimulus* very little under the ordinary standard; and it is not uncommon for the patient, though he cannot recollect being exposed to either an unpleasant quantity of heat, or cold, to go to bed with the eyes and eyelids apparently well, and to awake in the morning with the lids inflamed, and firmly closed with an adhesive matter. On carefully cleaning the lids with a little warm water, by evening the inflammation frequently subsides, and the part affected

nearly recovers its natural appearance. I
those cases, it will generally be found, tha
the patient, just before going to bed, ha
been either in a hot room or near the fire
and has gone out of doors, and expose
himself to the cool night air, which ha
brought on torpor, and a ſucceeding re
action.

Opthalmies of the most violent kind
have been ſaid to arise from a *metastas*
of the gonorrhœal poiſon from the *urethra*
to the *tunica conjunctiva*, or from careleſ
neſs and want of cleanlineſs, by the appli
cation of matter from the part affected t
the eye, by means of the finger, or th
handkerchief: latterly, however, the fa
has been a good deal doubted, and I thin
with great reason.

None, perhaps, will deny the probabilit
of the direct application of ſyphilitic, o
gonorrhœal matter to the eye, not bein
able to produce a disease, which, from th

length of time that its removal would require, would most likely terminate in the loſs of the ſight; but what I wish here to inquire into, is, the poſsibility, or the degree of probability of the matter of *gonorrhœa* being translated from the penis to the eye, or of the capability of a person to affect himſelf, by matter ſecreted from his own person.

A *metastasis* in the *gonorrhœa*, often takes place, when the change is made; either to the *testis* producing *hernia humoralis;* to the neck of the bladder, where it is attended with what has been called the *Algedo;* between the *præputium* and *glans penis* causing a ſpurious kind of *gonorrhœa;* or to the groins exciting buboes. In these instances, the *metastasis* may happen, from a premature or ſudden ceſsation of the primary discharge; but on that stopping, how the poison can ſo ſuddenly be conveyed to the eye, a part ſo distant, and whose action appears not to be con-

nected with the *urethra*, by any of th
known laws of the animal economy, i
what cannot easily be conceived.

It is true, Monsieur St. Yves ſays, th
the venereal Opthalmy is very rare, b
that he has ſeen ſeveral attacked with i
and that in most of them, the disease beg
two days after the commencement of
virulent *gonorrhœa*, that the matter, n
running off by the usual paſsages, was r
moved to the eye, through which it flowe
and ſtained the linen in the ſame mann
as gonorrhœal matter usually does.

Astruc also gives a long and minute d
scription of the venereal Opthalmy; but
attending to his description, it will
found, that he had never ſeen the disea
except in *one or two* of the patients, of t
younger Saint Yves, who, he ſays, had t
goodneſs to ſhow them him, and he ad
that the elder St. Yves was, he believes, t
first that described the complaint. He d

t give ſo terrible an account of it, as veral later writers have done, neither does reckon it ſo certainly fatal. His deiption of it is moſt minute; ſome parts of ich are fanciful, and given apparently m ſome preſuppoſed ideas he had formof the diſeaſe: others anſwer tolerably ll to the purulent eye. He ſays, that ugh the venereal Opthalmy ſucceeds a preſsed *gonorrhœa*, it is *only* in those ſons whoſe eyes are naturally weak and der; or who have had them hurt, either a blow or ſome extraneous matter, by ich he thinks a free entrance is *opened* the redundant venereal poiſon. The charge from the eye, he likewiſe adds, l *in a moment* ſubſide, on the return of original complaint.

Mr. Benjamin Bell, ſays but little about Opthalmy, from a ſuppreſsed *gonorrhœa*, acknowledges that it ſometimes hapS, and mentions the case of a young , " in whom the purulent discharge

" from the eyes appeared eight or ten da
" after the commencement of a mild g
" *norrhœa*, which came on after being he
" ed with drinking port wine, when t
" discharge from the *urethra*, which h
" previously been copious, disappea
" almost entirely. By a quantity of bl
" being taken from the temporal artery
" one side; from the division of ſuch veſ
" on the eye balls as were turgid, a
" the ſcarification of the inflamed part
" the eye-lids; by the application over
" eyes of poultices in which opium, a
" *ceruſsa acetata* were diſsolved, and ge
" laxatives, the pain, inflammation, a
" discharge of matter ſoon leſsened, a
" in the course of a fortnight, no ſymp
" of the disease remained, but a degre
" irritability on exposure to much li
" with which both eyes continued t
" distreſsed for five or ſix weeks a
" wards."

When a person has a *gonorrhœa*, on the
pplication of a greater quantity of *ſtimulus*,
s the drinking of much wine, as in the
ase of the young man mentioned by Mr.
ell, the inflammation would be increased,
ut no ſuppreſsion of the discharge would
ke place, unleſs on exposure to cold,
hich at the ſame time would be liable
bring on torpor, and a ſucceeding in-
mmation of the eyes, more especially if
ey were already weak; which makes
e ſuppose that the ſame imprudent ex-
sure to cold, that caused the diminution
the discharge from the *urethra*, for it was
ſuppreſsed, produced the inflammation
d discharge from the eye. This ſup-
ition is farther ſtrengthened, from Mr.
proceeding to ſay, " that in the course
of the following year, on the ſame per-
son being attacked with a *gonorrhœa*, but
of a more violent nature than the for-
mer, he was again ſeized *after exposure
to much cold*, and riding on horse back,
to a ſimilar affection of his eyes." In

this instance too, blood letting, and th
remedies formerly prescribed, proved fuc
cefsful.

Mr. Ware, in his " Remarks on tl
Opthalmy, &c." takes notice of the observ
tion of Mr. St. Yves, upon which he mak
the following ftrong remark; " this accou
" is the more furprising, because fuch
" effect as is here described, has never be
" observed by other writers on the fubje
" or any one of the faculty, with whor
" am acquainted; though fome of th
" have had a long and extensive practi
" both in the Opthalmy and *gonorrhœ*
and the fame, I believe, will be confe
by every medical man of experience
observation; and I trust, we fhall no
going too far, in declaring, that tl
cases which have been faid to be ow
to a fupprefsed *gonorrhœa*, have b
caused by cold; Astruc, we find, f
that it only happens in those per
who have naturally weak eyes, or

ws, and foreign bodies inserted between lids, and Mr. Foote, in his treatise on venereal disease, ſays, that he does not eve in this doctrine of *metastatis*.

here is another method by which it uid, the eye may be affected with a *rrhœa*, and that is, from the patient veying, by his fingers, or any other ns, the matter from the *penis* to the which it is aſserted, will bring on an nalmy, accompanied with a discharge, ar to that which had previously taken e from the *urethra*: but however pro- e that may appear in theory, it would xtremely difficult to prove, that it has ened in one instance, by experience. e it poſsible for the eye to be affected at manner, other parts would alike posed to its baneful action, and what tful ſource of misery would be let in mankind?

Fortunately, however for us, it appe
that we are incapable of infecting oursel
by our own diseased ſecretions, which
caused by the direct application of poi
On the application of any ſpecific poi
as the gonorrhœal, to our body, a
tain diseased action is brought on,
gonorrhœa produced; the matter
which, is capable of exciting a ſi
disease in another person, though unal
contaminate the body that produced it.
was not for that law of the animal econ
every infectious disease must be fatal.
ter from a chancre, would cause
chancres, and those again, other
till the whole body was covered,
death closed the ſcene. The ſam
be ſaid of *gonorrhœa*, and other di
which owe their action to a peculiar
The poison of the viper, Mr. Foo
does not affect the viper that ſecr
though it will another viper, or an
animal into which it is effused.
been before remarked, that ſyphi

onorrhœal matter being applied to the ye, would produce its baneful effects on ; that however is a disease which is not ere alluded to, but the ſecondary one, hich is the ſame that has been meant by riters on the ſubject.

Mr. Foote in denying the poſsibility of atter from the ſame person, infecting him a different part, gives two cases in which gonorrhœal Opthalmy appeared about the me time as the diseased action ſhewed elf in the *urethra*. In both of which, it as very probable, that the matter from e infected person, was applied to the es. In one of the cases, the patient, who d weak eyes, was in the habit of wash-g them with his own urine, and which did, half an hour, after he had had con-ction with the woman who gave him the *norrhœa*.

Mr. Ware ſeems to think it very doubt-l, if a person can be affected with a dis-

case of the eyes, from the application of
own gonorrhœal matter, and though
ſhould not be authorised to put the ma
to the test of experiment, yet I appeal
every one who has had much opportunity
observation in these matters, whether
has not ſeen many patients who, to a w
of common cleanlineſs, have added a g
degree of inattention, to prevent any
effects that might arise from the applica
of the poison to other parts of the body,
when the discharge has been copious, h
not only handled the parts a good d
but even wiped off the matter with t
pocket handkerchiefs, and yet the eyes
well as every other part, have not b
affected. Whatever part is in pain, att
most our attention, and we naturally a
our hand to it, and this hand is often ap
to the eyes, the nose, and the mouth; fi
then, if it were poſsible to infect the
that kind of Opthalmy would be very
mon, and yet I have never met wit
I confeſs, I have repeatedly attended

vho, at the ſame time, laboured under *onorrhœa*, and had a profuse discharge of matter, ſimilar to *pus*, from the eyes, and which the patients have attributed to the *onorrhœa*, but which clearly was the common purulent eye, which if it happens to ome on when the *gonorrhœa* is present, he discharge being ſimilar, has been ſupposed, without much examination, to proceed from the ſame cause, and has probably iven rise to the idea of the gonorrhœal pthalmy.

Though the purulent discharge from the e is most common to children, yet it ot unfrequently is met with in adults, here there has not been the least ſuspicion a venereal taint; and I have ſeen it exemely copious, and as far as the external ppearance of colour, consistence, and aining the linen, exactly ſimilar to gonorœal matter, and ſometimes attended with great deal of pain. Had this happened ith a *gonorrhœa*, what would have been e general conclusion?

It has been ſupposed too, that inflam mations of the eyes may be brought on the ſystem being universally infected w *ſyphilis*, though it does not appear, writers on the venereal disease, that it h any particular action on the eyes; and the Opthalmy has been observed to ta place when mercury has been given rath largely, to correct or remove the origi ſyphilitic taint, and which of course w render the constitution peculiarly liable inflammation, from the ſlightest concurre of exciting causes. If it is neceſsary to g this disease any name, and allowable ſeek one from a predisposing cause, it wou perhaps, accord more with its nature to it the Mercurial Opthalmy.

It has been also said, that Opthalmies at times epidemical and contagious, and they depend on ſome peculiar property the ſurrounding atmosphere. If by peculiar property in the atmosphere is me its relative qualities with respect to h

d cold, moisture and dryneſs, &c. which ay bring the body into ſuch a ſtate as to ake it much more ſusceptible of taking on seased action, from any irregularity in e application of the usual *ſtimuli* in- cing inflammation, I have no objection the term; but if, by it, we are to under- nd that, at times it is probable the air y contain certain opthalmic particles, if may be allowed the expreſsion, which, en applied to the body, will produce a cific disease, as variolous effluvia causes allpox, I must confeſs it appears to me ghly improbable.

Inflammations of the eyes ſometimes come very ſuddenly, and apparently without y ſufficient preceding cause; this, by common people, is called a *blast*, and s by them been referred to ſomething xious in the air, and connected confusedly, heir minds, with what they have observ- to happen to trees. It is, likewise, no usual thing to ſee ſeveral people in one

family, affected at the ſame time, w
Opthalmies: this happens generally am
the poorer claſses, and commonly eithe
the ſpring or autumn, when the ſtate of
atmosphere is particularly variable, and
changes from heat to cold are daily,
often ſudden.

When the Opthalmy is more freq
than usual in any particular district,
generally attended, more or leſs, wi
discharge ſimilar to *pus*, from the
which probably has ſome effect in ſprea
the disease. Though nearly the who
a family may be affected at the ſame t
it ſhould be recollected, that they ar
exposed to the ſame exciting causes,
that among the poorer claſses especi
they are not ſufficiently careful to dry t
ſelves after washing, with different cl
and cases have come under my observa
in which it was very probable, tha
purulent discharge, which is at tim
acrid as to excoriate the ſkin in the vic

f the eye, applied to another person's eye, roduced inflammation, probably from its ritating quality: for it was not always ucceeded with a ſimilar discharge.

It has been aſserted, by ſome able physiogists, that the veſsels being thrown into ich a diseased action, as to produce various or rubiolous matter, or *even common us;* that this matter applied for the first me, to any part denuded of its cuticle, or here it is very thin and ſensible, a ſimilar tion will be induced in those veſsels, and e ſame kind of matter ſecreted: but that, they have already gone into that kind of tion, they are not again ſusceptible of it: he matter acts as an irritating ſubstance, d a ſlight inflammation only is induced. ranting that to be the fact, will it not count for the application of matter from e perſon's eye to another, ſometimes producing a discharge of purulent matter, and another only a ſlight inflammation?

THE CURE.

HAVING now, rather in detail, men-
oned the occasional remote causes of
)pthalmy, it may be requisite to ſay a few
ords, on the proximate cause, or that
eculiar action of the veſsels, which con-
itutes inflammation. It is not my inten-
on, to discuſs the improbability of the
ultifarious causes, which have been ſup-
oſed to be the immediate occasion of in-
ammation, or to point out the ſtrong ob-
ctions, that might be made to many of
hem; that belonging more properly to a
reatise, written profeſsedly on the ſubject
f general inflammation.

It will be ſufficient for our purpose, to
ay, what, on taking a view of the various
causes, which have been ſaid to bring on

inflammation of the eyes, appears the mo
probable, and which, I trust, will lead u
to a more rational plan of cure.

Were I to examine the whole body,
discover that part, which was the mo
proper, from the facility with which a
extraneous bodies act on it, and the quic
nefs with which any change, in its circ
lation, is fhewn, I could not fix on o
more adapted to fhow the nature of i
flammation, than that to which these pag
are devoted, the eyes; from which I w
take an example of the effects, and acti
of a body, whose power is owing to qu
lities, about the nature of which there
little doubt.

A particle of fand being inserted b
tween the lids, and the globe of the ey
by its mechanical irritation, ftimulates t
vefsels, or the fibres against which it
immediately applied, into more freque
and ftronger contractions, and a flig

lneſs is immediately visible; by aſso-
ation, the lids are forcibly closed; the
ntents of the excretory duct of the lach-
mal gland, is preſsed out; and the eye
ſuffused with tears.

If by the flowing of the tears, the ſand
removed, the irritable fibre being ſti-
lated not more than usual, the increas-
action of the veſsels ſubside, and the
culation is carried on as before.

But, if the irritating ſubstance ſtill re-
ins, the contractions of the fibres increase
h in frequency, and force, the veſsels,
oining to those first affected, are brought
o action, by aſsociation, and these
in cause those that are nearest to them,
contract, till the parts are affected for
e distance from the fibres, first ſtimu-
d.

Now, ſupposing one of the circular fibres
an artery to contract, with a greater

energy than usual, which will ſudde
bring the ſides of the veſsel nearer to e
other, and diminish its diameter, it
follow, that there will be a ſtronger
mentum, and a greater quantity of bl
propelled against the next circular fil
than before, which, at the ſame time
it enlarges its diameter, will ſtimulate
contract more violently: the same rea
ing will hold good with respect to
adjoining fibre, by which the resistanc
the minute veſsels, which commonly a
only the transparent part of the blood,
be overcome, and red globules admit
these and the increased distention will
as ſtrong ſtimulants and produce
which will ſtill add to the irritation.

If the increased action and pain con
for ſome time, though the original cau
the disease be removed, the inflamm
will remain; for the activity of the irri
principle in the part being greater, the
sels acquire new habitudes and new act
which keep up the diseased motions.

When the inflammation is only ſeveral ays in ſubsiding, after the removal of the xciting cause, as it is continued by the pain hich arises from the enlarged diameters of e veſsels, and the ſubsequent force of the ontractions, on the pain remitting, the in-ammation diminishes, and the action of e veſsels partially return to their ordinary ate, and, after a few remiſsions and exa-rbations, health is restored.

That the enlargement of the veſsels, in hat is called active inflammation, depends the resistance from the irritable principle ident in the arterial fibres being overcome the *impetus* of the blood, appears from e experiments of Dr. Buvina, who found t, on injecting fresh blood into the blood-ſsels of living animals, the blood only, netrated into those veſsels in which red ood circulates during life, but having ſud-nly killed the animal, by dividing the nal marrow, the injections immediately netrated to the most delicate veſsels of

the *periosteum*, and other parts, giving the
a red colour, which they have not in t
living animal.

Since a variety of ſubstances produce t
ſame effect on the eye, as the grain of fa
just described; but which, from their fo
or appearance, do not indicate that qualit
we are, perhaps, authorised in concludi
they owe their power also to their ſtim
lating nature. The first we may cal
mechanical *ſtimulus*, the latter a chemi
one.

The chemical *ſtimulus* from the ful
manner in which it operates, and its be
more diffused, and applied to many fibre
the ſame time, is more apt to produ
violent disease.

As the increased action of the veſsel
the very eſsence of inflammation;
though the pain, and the greater h
when present, add much to the irritat

they are only the consequence of, and ndant on, the increased action; to re- ve which, our principle attention ought e directed.

t has already been ſhown, that a ter action than ordinary in a part, must end either on the usual *ſtimuli*, or the able principle being increased; it will efore neceſsarily follow, that to di- sh the action, the *ſtimuli* or the irrit- principle must be leſsened.

he common external *ſtimuli* may be eased, or a new one added; or the ons of the part, may, by the pain, the distention produced, act as *ſtimuli*, or the new motions may in- se the quantity of the ſupply, or the ity of the irritable principle.

is universally agreed, that, when the mon *ſtimuli* are increased, they ſhould noderated, or if any other is added,

that its removal ſhould first be effec
before any thing can ſucceſsfully be ap
ed, to the eye, to take away the infl
mation. I ſhall proceed, then, to p
out the most eligible means of remov
or obviating, the ill effects of the exci
causes.

1. Blows. On a violent blow b
given to the eye, it is to be feared th
derangement of the internal parts wil
produced, which may terminate in
loſs of ſight; our care, however, in
first instance, is to moderate the inf
mation, to do which, it will perhap
more neceſsary to remark, what ough
to be done, than to point out what ſho
as, I fear, our extreme officiousneſs,
often been the cause of more mischief,
the original injury it was intended to c

By a blow, the healthy actions of a pa
deranged, to restore which, is out o
power of art; it must be the work o

re, and on the first infliction of the in-
ry, ſhe is generally, more inclined to do
much, than too little. The common
thod of applying bandages, and com-
eſses on the eye, with the intention of
eping out the light, or preventing the
tion of the lids, ought not to be adopted:
me also to prevent, or moderate the in-
mmation, use poultices of various kinds,
cloths wet with different articles, and
und on the eye, all of which are highly
proper and injudicious; for by confin-
g the tears, and increasing the heat of
part, as well as by their preſsure, they
d much to the inflammation.

Practitioners very frequently order linen
ths, wet with different kinds of lotions,
be kept constantly applied to the eye,
th after blows and wounds, as well as
common inflammations; and this they
, not ſo much, perhaps, on the ſuppoſi-
n that their lotions have any ſpecific
wer in abating inflammation, as to keep

the eye more cool, upon the principle t
water is a better conducting *medium*
heat, than air, and that the evaporati
that takes place from the wet cloth, afs
in ſubstracting the heat.

This mode of reasoning is fallacious;
although it is well known, that a cer
quantity of water will transmit h
quicker, than a given quantity of air,
that the evaporation which is always g
on from water, makes it in ſummer
degrees cooler than the air, and that e
a bottle, containing liquor, and wrap
in a wet cloth, becomes cooler, as is v
known in hot climates, where they
their wine by that proceſs; yet the anal
will not hold good when applied to
animal body.

In one case there is a certain quan
of heat contained in a body, which i
a temperature nearly equal to its o
which is diminished by the evaporatio

e water; in the other, the wet cloth is plied to a body, at a much higher tem-rature, and whose heat is being per-tually renewed.

A wet cloth being placed in contact th an inflamed part, in two or three nutes, becomes the heat of the ſkin, d the external part of the cloth, which will ſuppose to be four or ſix folds, will found, on trying it with a thermometer, th before, and after the application of e cloth, to have ſunk only *two degrees*, d even this ſmall diminution of heat, ıst not be attributed to the ſkin being oler, but to the heat ſubstracted from e external ſurface of the cloth by evapora-n, as we find that in warm weather, ater is that much cooler than the air.

The application, then, of a wet cloth, es not diminish the heat of the ſkin, but e part of the cloth in contact with the dy ſoon becomes dry and hard, and acts

as a ſtimulating ſubstance, independ
of its weight, and every one who is at
conversant with diseases of the eyes, m
have often observed how ſmall a preſs
on the lids, is productive of evident irr
tion, and an increase of the inflammatio

If a thin piece of linen cloth, was alw
to be kept uniformly wet, by a reg
ſupply of moisture, which would
attended with a great deal of trouble
inconvenience it probably might be
viceable; but the application of a
cloth to the eye, which is renewed e
two or three hours, which is the u
mode, is undoubtedly prejudicial.

Little more can be done directly
a blow on the eye, than keeping the
tient cool, putting him on an antiphlog
plan, proportioned to his habit of body,
the nature of the ſymptoms, and desiring
irritating causes to be avoided. The eye
be bathed ſix or eight times a day,

kewarm † water, and kept ſhaded from e light, particularly if it gives pain.

I mention warm water, to be made use of, to wash y any irritating ſubstance, whether it is a foreign body, natter ſecreted by the eye, which is often found in ſmall icles, and occasions a good deal of pain; and when I e to ſpeak of the cure of the Opthalmy, in the ſecond , I ſhall make it appear, that the application of warm er is much more beneficial than cold. This aſsertion, ever, is only to be considered as applicable to the in- ent ſtage of an Opthalmy; for after it has put on the atonic n, cold water is often moſt proper. How difficult is it to get better of preconceived opinions, particularly when ſup- ed by ſomething like reason! To ſuperficial observers, inconsistency appears ſo evident. If a part is hotter than l, ſay they, ſhould we not endeavour to cool it, by ying cold water, and how absurd it would be, to use m water when the part is already too hot!

lthough they ſhould find, when the ſensation of cold- from the water was gone off, that the part was more nful than before; or if they ſhould be prevailed upon ake trial of warm water under a disguised name, and call *fomentation*, and ſhould find eaſe; that the *ſtimulus* of the t from the water could be ſerviceable to them, would be farthest from their thoughts.

claim not this as a new practice, though I hope to ex- its application, by pointing out in a more decided nner than has hitherto been done, the utility of it. A . Benedict Duddell, who ſtyled, himſelf ſurgeon and

In almost all cases of inflamed eyes, so advantage will be received from the use o shade, which will be found to do as mu good, as bandages and poultices often harm. With respect to the kind of sha that is most proper, I would recommend paste-board hood, to be worn, at a greater less distance from the eyes, as the particu case may require. The hood should made of a size, not larger than will k off the necessary degree of light, and w be better if lined with black, instead green, silk, as is commonly done.

oculist, and who published in 1729, "A treatise on horny-coat of the eye, &c." almost universally recomm the application of warm water, in diseases of the which he orders to be used *incessantly*, for twelve hour gether, and, as he says, with great success. Mr. Ware in "Additional Remarks on the Opthalmy," in his "marks on the *fistula lachrymalis*," says, that in some cas Opthalmy on applying "hot water to the eye, the c "was highly grateful, both *cooling* and *strengthening* the "to which it was applied." He attributes its good eff unphilosophically, to the cooling process that takes plac the evaporation of the water;—but I must defer ente farther into this question, till I come to speak of its op tion in abating inflammation.

It ſhould be recollected, that this hood only intended as a ſhade, and ſhould not eſs the head too much; to overheat it, or me very far over the face, to exclude the ol air. If a ſmall bit of cane or whale-ne, of ſuch a length, as to go almost und the head, is firmly ſewed to the in-le of the upper part of the ſhade, and en tied behind, with a ribbon, to the ſize the head, the lower part will be thrown t from the eye, and from the ſlightneſs its preſsure; the facility with which it raised higher or lower; and the ſteadi-ſs with which it preserves its ſituation, nost any quantity of light may be ad-tted, according to circumstances.

The eye-lids and the adjoining parts are quently discoloured after blows, and as appearance is very unpleasant, its ſpeedy moval is very much desired.

A great many things are thought, by the mmon people, to have the power of re-

moving this appearance in a few hours; a
raw meat bruised and laid on the part
Solomon's ſeal, conserve of roses, &c. bu
the powers of animal life are not ſo easil
or quickly excited to do what is wished
them; the change must be gradual, an
time given for the absorption of the blood
though it may be expedited, by the freque
application of any gentle ſtimulant, as equ
parts of alcohol and water, with a litt
camphor, tincture of opium, or æther d
luted.

2. Wounds: — On any instrument
ſubstance penetrating the eye, nearly t
ſame mode of treatment ſhould be adopte
as in blows. If the *tunica cornea*, or *ſcle*
tica is divided to any extent, the ſight w
be very much endangered, and as the p
servation of the eye, if it is poſsible to p
serve it, will depend on the wound heali
ſpeedily, the greatest care ſhould be tak
that the curative proceſs of nature be
interrupted by the circulation in the p
being hurried.

The patient must be requested to keep e eye-lids closed, and ſhould be con- ned to a cool, dark room, with nothing all over or upon his eyes ; but if the lids e inclined to adhere together, and confine e tears, their edges may be kept constant- moist, by the application of any mild ntment ; though it generally answers the rpose better, if the ointment is made ſole- of animal fat : costiveneſs ſhould be ob- iated ; febrile ſymptoms moderated ; the ntiphlogistic plan attended to ; and any atter that may be formed gently and care- lly removed, by bathing the eye with a ttle warm water.

If bandages, &c. are prejudicial after lows, they are much more ſo after wounds f the eye, though their application to uard the eye from the light, are, in gene- l, ſo much more convenient to the friends the patient, than confinement in a ark room, that they are too often had re- ourse to.

When the wound is healed, and an in flammation remains, it must be considere as an inflammation arising from any oth cause, whose original exciting cause h been removed, and treated accordingly.*

For the extravasation of blood, under tl *tunica conjunctiva*, which is the consequen of the division of a blood-vessel, the app cation of the vapour of æther, on account its penetrating quality, has been much e tolled. Probably this penetrating quality æther is merely imaginary, it not being al to pass the external membrane, and that t good effects, resulting from its use, ought

* How much more rational is the present mode of treat wounds of the eye, to what it was formerly! when, after depression or the extraction of the cataract, the unfortu patient was confined to his bed, his eyes bathed with a var of *powerful specifics*, and covered with a load of bandages three or four weeks! When the bandages were remo that his best friend, cool air, might be admitted to him moderate the inflammation, alas! it was then often too l and the miserable victim, sacrificed to mistaken princip was doomed to darkness.

attributed to its ſtimulant powers; as I
e found, the dropping a little ſpirit and
ter into the eye answer equally as well.

In ſpeaking of the ſubsequent ill effects
wounds or blows upon the eye; an opa-
y of the chrystaline lens, was mentioned
an occurrence not infrequent: these kind
cataracts, as well as many others, are
nerally thought incurable, and the whole
pendence of both the patient and the prac-
oner, has been either the depreſsion or
raction of the cataract. In many cases,
ave been ſo fortunate, as as to impede or
p the progreſs of the disorder, and in
ne few, to remove it, when fully formed.

In the ſucceeding part, when I come to
at on the consequences of inflammation
the eyes, I intend laying before the pub-
, my mode of treatment, in opacities of
e chrystaline lens, with ſome cases in
hich it has been attended with ſucceſs:
it ſuffice at present to ſay, that I chiefly

depend on the application of a variety
ſtimulants to the eye, of ſuch a ſtrengt
and repeated as often, as may be ſufficie
to keep up a moderate, but perpetual, ir
tation.

3. Warts and tumours on the lids a
mentioned as another cause of inflamm
tion. Warts, after arriving at a certa
ſize, generally ſuppurate and disappe
but if they are productive of pain, th
ſhould be removed.

If the warts are attached to the lids b
ſmall pedicle, they may be cut off wit
thread, or more expeditiously by a pair
ſciſsors, or a ſcalpel.

It is those, however, in general, wit
large broad base, that we are consulted ab
The best way to remove them, is to
them off even with the ſkin, with a ſn
ſcalpel, and then touch the part with c
stic; a ſmall ſlough will be formed, and

ppuration that ſucceeds will take away e remainder of the wart.

In removing tumours of the encysted nd, from the lids, authors commonly commend the ſkin to be divided, and the mour to be diſsected out entire: this, if it ſituated on the upper lid, is often a trou-esome and painful operation, and I think , attended with unneceſſary violence; least in a great many that I have remov-, I have always found it ſufficient, merely lay open the cyst, by cutting into it ough its whole extent, and after evacuat-its contents, to bring the edges of the und together by ſmall ſlips of adhesive ster, when in a day or two it generally als by the first intention.

4. The mode of treatment, with the rea-ing on the nature and cure of the Op-lmy, arising from an inversion of the s, is ſo accurately given by the inge-us Mr. Ware, in his Remarks on the

Opthalmy, and ſo perfectly accords with m
own experience, that I ſhall beg leave
give it in his own words.

" For an Opthalmy, produced by an i
" version of the lids, a palliative cure m
" be effected, or to ſpeak more conformal
" to the fact, a present and temporary rel
" may be given to the patient, by taki
" out the lashes, with a forceps, a pair
" knippers, or any instrument of the li
" kind. But while the lids retain this
" verted ſtate, no ſooner do the hairs gr
" again, than the disorder will again retu
" nor can the patient be ever properly f
" to be cured of the complaint, till
" edges of the lids are restored to their
" tural position, and can be kept in it."

" It is, however, neceſsary, that a
" tinction be made between an inversio
" the upper and lower lid, for though
" inversion of either will produce the f
" effect, yet in the different lids it app

to arise from different causes, and consequently to require different methods of cure."

"The upper lid, and its ciliary edge, both in motion and at rest, are preserved in their natural ſituation, by the equal, though contrary actions of the *musculus orbicularis*, and *Levator palpebræ ſuperioris*. But the lower lid, whose motion is very ſmall in comparison with that of the former, has no muscle correspondent to the elevator of the upper; and is preserved in its natural ſtate, by the equal action of the orbicular fibres ſpread over it, and the counteraction of the ſkin which covers it; in which last respect it differs materially from the upper lid, the ſkin of which, on the contrary, being always very thin and flaccid, is incapable of any ſuch counteracting power."

"From the above account it is manifest, that when the *trichiasis* affects the upper

"lid, it muſt be owing to a relaxation
" the *elevator palpebræ ſuperioris*, and
" contraction of the ſuperior part of tl
" *orbicularis;* whereas in the case of
" *trichiasis* affecting the lower lid, it c
" only arise from a relaxation of the ſki
" and a contraction of part of the *orbi*
" *laris.* And as in these two cases, t
" causes of the disorder are very differe
" ſo they will of consequence, require
" very different treatment. In the *trichi*
" of the lower lid, it will be neceſs
" to increase the counteracting power
" the ſkin, which covers that lid, ſo a
" prevent the undue contraction of the *m*
" *culus orbicularis*: whereas in the *trichi*
" of the upper lid, it is plain that
" ſole objest of attention, must be to g
" an additional *ſtimulus*, to the *Lev*
" *palpebræ ſuperioris*, for the purpos
" exciting it to action."

The *trichiasis* of the upper lid hap
but ſeldom. But in an instance of

ind, that did occur, an entire cure was oduced by a friend of Mr. Ware's, on a ung gentleman 18 years of age, by mak- g an incision through the integuments the upper lid, from the inner angle of e eye to the outer, and then ſeparating e fibres of the *orbicularis*, ſo as to de- idate the expanded fibres of the elevator uscle, as near to their termination in the ge of the lid as poſsible, and applying ſmall cauterizing iron, adapted to the nvexity of the globe of the eye, and ade pretty warm, to the tendino-carnous res.

The thought was certainly ingenious, d answered the purpose of curing the version of the ciliary edge; at the ſame me, producing a ſlight eversion of the lid, hich though its appearance is unpleasant, uses none of the disagreeable effects of e other. The gentleman ſays, the iron as made pretty warm, and that he paſsed two or three times over the fibres. I

conclude, therefore, that the iron did n
as was ſupposed act as a *ſtimulus*, excitin
the muscle into greater action, but w
ſo hot as to produce a ſubſequent inflamm
tion, if not an escar, ſufficiently great
cause the fibres of the *Levator palpeb*
ſuperioris, either to adhere to each other,
to the neighbouring parts, and by that mea
prevent their natural action; as happens
the adhesions that follow burns.

Though it has been ſaid, that the wea
neſs of the contraction of the *Levator p*
pebræ ſuperioris is the cause of the *trichi*
of the upper lid, yet an inversion of
ciliary edge may be produced, not ſo m
by that muscle being weaker than usu
as from its having a greater resistance th
natural to overcome, by the ſkin be
thicker and more relaxed, or the cellu
membrane enlarged, by the deposition
a ſmall quantity of ſebaceous matter, wh
will require a greater force to move
elevate it.

In that case undoubtedly, and probably ſome others, advantage might be obtain-l, by applying ſmall ſlips of good hesive plaster to the ſkin, between the per lid, and the edge of the orbitar oceſs of the frontal bone, paſsing it over e eye-brow to the forehead, and draw-g the ſkin in folds under it. An effect nething ſimilar to what is intended by e above contrivance, is observed in com-n life, as people when they are drowsy, d make great voluntary efforts to keep eir eyes open, or to ſeparate their lids der than usual, corrugate the ſkin of the ehead, by the contraction of the *corruga-es*, *ſupercilii*, and the *occipito-frontalis* uscles.

Relief too, in ſome instances would bably follow, as ſuggested by Mr. athen, from the application of an iron g, ſo adapted to the form of the orbit, at part of it may preſs on the cartilage of e lid, and prevent its inversion; and

frequently a very trifling prefsure wi answer the purpose. The ring fhould l covered with filk, and made to fasten to tl head with a ribband, by a projecting pa from each fide of the ring, to which it ma be attached.

The *trichiasis* of the lower lid, is a mu more common complaint, and when i cent, can generally be cured, by a prop application of adhesive plasters. Oft nothing more will be requisite, than make a fold in the fkin below the inver lid, by drawing its edge from the eye, a fixing on a-piece of adhesive plaster to ke the fold in its fituation.

But it fometimes happens that there almost a constant flow of tears from eye, particularly on touching the which moistens the plaster, that it eit cannot be fixed firmly on, to preserve necefsary fold of the fkin, or if it c adhere at first, the constant moisture f

osens it, on these accounts the use of lhesive plasters, has been often laid ide as ineffectual, when a little more tention to their application would have rformed a cure, with ease.

I have frequently ſucceeded in ſuch ses, by placing the patient's head in ſuch ſituation, that the tears, instead of nnning down the cheek, ſhall paſs out, the external angle, and by these means event the part, on which the plasters are be placed, from being moistened, and en wiping it perfectly dry, have fixed e end of the plaster as near to the edge the lid, as I conveniently could, and lling the other end, have turned out the verted edge as much as requisite, before e end, that was held between the fingers as applied to the cheek. At times two three thin ſlips of adhesive plaster must fixed on, though one is generally ſuf-ient.

It is not absolutely neceſsary, that tl plasters ſhould be applied to the edge the lid: indeed in ſome cses, if they a placed at a little distance, they will ſucce as well, if not better, from much larg pieces of plaster being made use of, a the fold of the ſkin increased. The e proposed can occasionally be obtaine with great facility, by placing a piece adhesive plaster half an inch broad, a two inches long, nearly an inch bel the edge of the lid, and having fixed half of it, a probe being placed under plaster, near that part which adheres, a pushed upwards, a very considerable f may be made, which will prevent inversion of the lid, and by the contract of the corrugated ſkin, remove the caus the complaint.

Most medical writers on disorders the eyes, have described and recomme ed different forms of instruments, wl by taking hold of a ſmall portion of

in, beneath the lid, and hanging by it, ay by its weight, keep the lid from rning inwards, which, they ſay, will the end cure the disease.

I do not doubt the application of an strument, frequently answering the end oposed; at the ſame time, I must observe, have met with no case in which ſuch instrument would be applicable, that ight not be cured by a proper use of hesive plasters, which ought certainly have the preference, as they give much s pain and inconvenience, not to men- n the unsightly appearance of a piece of n depending from the cheek.

When the *trichiasis* is ſlight and recent, e application of adhesive plasters, will mmonly be ſufficient to restore the ſkin its natural ſtate, but in more obstinate ses, when the inversion is great, and the in about the eyes very much relaxed, may be neceſsary to cut off a ſmall por-

tion of the loose ſkin, below the edge lid, and afterwards confine the lips the wound together, by means of two three ſutures. The wound heals in a fe days, and the lid is generally restored to proper place.

In those cases, however, in which t ciliary edges are not only inverted, l also contracted in length, neither of t above methods will ſucceed; under ſu circumstances, relief is only to be obta ed, by enlarging the circumference of ciliary edges, either by making a ſm incision in a right line from the outer angle allow of ſufficient motion to the lid, or a compleat division of the cartilage of lid, through the middle, which will ca each edge to recede towards the ang leaving a division between them, wh will not only remove the complaint for present, but prevent the poſsibility of return in future.

When the Opthalmy proceeds from a eternatural row of hairs, growing out of e inner termination of the edge of the lids, hich is generally attended with much ouble and distreſs, no means have hitherto een devised, better than the extraction of e ſupernumerary hairs, which only gives mporary relief; for though other attempts ve ſometimes been made, they have prov- ſo very unsucceſsful, as not to deserve rther notice.

5. The fortuitous insertion of extraneous dies between the lids, is another frequent use of inflammation. These, during their ntinuance in the eye, produce great pain, d an inability to move the lids, with an creased secretion of tears. The flow of ars is, in general, ſufficient to wash away e offending ſubstances; which, on their ling to do, they must be removed by means propriated to the nature of the adhering dies, or the manner in which they are ed in the eye.

The foreign bodies being either ſand dirt, the lids may be ſeparated by tl fingers, and on the patient being desired look towards the opposite side to that which the extraneous ſubstances lie, th may often be removed with wet lint on t point of a probe, or with a ſmall pair forceps.

When there is reason to suppose there a many particles in the eye, it may be nec sary to throw a ſtream of warm water o it, by means of a syringe, or to immerse t eye in a wine glaſs filled with water.

An eye cup, whose ſhape is adapted the form of the eye, is generally reco mended to be used in these cases, as w as for the application of lotions in Opthalmy, which is very often attenc with an evident increase of the complai

If a common wine glaſs is filled w water, and the head being bent forwa

e edge of it is gently prefsed between the wer lid and the cheek bone, the whole of e anterior part of the globe may be easily vered with water, and the upper lid lowed free motion: the depending situa-n of the head also, will permit more sily the removal of the offending particles.

But in applying a common eye cup, the efsure on the lids is considerable, and the at from the eye rarefies the air in the p, fo much as to cause a considerable efsure and irritation; the quantity of ter made use of is much fmaller than th the glafs, and the head being held ck to fuffer a more free admifsion of the ter, the probability of the extraneous body ng washed away is diminished.

When the adhesion of the extraneous body so strong as to resist these attempts to nove it, it may be endeavoured to be arated by a thin blunt pointed fcoop, nething larger than a common probe, or

lastly, on that proving ineffectual, wi the point of a lancet, taking great ca that neither the *cornea* or the *tunica co junctiva* is wounded, which, in the fi case, might leave a ſcar that would aft wards injure vision; or in the latter cau ſo much irritation, as to render the ſub quent inflammation dangerous.

If the extraneous particles adhere closely to the inside of the upper lid, t a free application of water is not ſuffici to remove them, it will be neceſsary turn the inside of the lid outward, wh may be done without much difficulty the lower edge of the lid, or part of the e lashes, is taken hold of between the thu and finger of one hand, whilst a probe any ſimilar instrument, held in the o hand, is preſsed on the outside of lid, a little above the edge of its cartil On the lid being averted, the for particle is brought directly into view, w it may be removed, as was before direc

ther by a little lint on a probe, or, in case necesſity, by the point of a lancet.

Lime, from its general consumption, and ing often in exposed ſituations in consi-rable quantities, frequently by the care-snes of workmen, or the playfulneſs children, gains admiſsion to the eye, d is the cause of violent inflammations, d the most dreadful head-aches, follow-by a large formation of matter, in the ambers of the eye, or extensive ſuppu-ons of the *cornea*, ending in incurable dneſs.

Lime, applied to the living fibre, is a ng ſtimulant, and acts as a violent stic, from its tendency to unite with ſebacious matter of the body: in its unslacked ſtate, it is very greedy of sture, and in ſuddenly absorbing water es out much heat, which considerably litates this combination.

Any large particle of lime ſhould b immediately removed, by the means abov recommended, for extracting ſand, or dirt and as the most ſerious consequences ar to be apprehended, from a ſmall quantit only remaining in the eye, it ſhould b well bathed with ſome liquid.

Lime will unite with water in a ve ſmall quantity, and with the expreſsed oi more easily; but as it will combine wi great facility, with all acids, they, in the diluted ſtate, ſeem to claim the preferenc as an application in these cases. I have fr quently found common vinegar, dilut with three or four times its bulk of wat applied with a wine-glaſs, as before dir ed, answer very well, and, as in case emergency, it can generally be procurre it makes it the more convenient.

It is true, the diluted acid acts as a mulant, yet in the degree of ſtreng mentioned, it does not give much pa

d although it produces a temporary in-
ase of the inflammation, the action of
e part ſoon abates, particularly if it is
mersed in a little warm water, and the
moval of the whole of the lime, is ſo de-
able, that any momentary pain ought to
disregarded.

Let me again urge the neceſsity of the
most care being taken, to wash away all
lime that may adhere to the eye, hav-
frequently ſeen the worst effects arise
n inattention on that head, though it
not at first attended with much pain,
pparent injury.

On examining the eye, after lime, in
quantity, has been in it, part of the
a, or *conjunctiva* will be found white,
have the ſame appearance as is ſeen,
n ſtrong caustic is applied to other
of the body, and in fact a combination
taken between the lime, and the
nal fibre; and as that must be remov-

ed, and new parts formed, by a peculi animal proceſs; care ſhould be take least that ſenative action be interrupte by the injudicious application of ſtimula medicines.

The eye ſhould be defended from light by a paſte-board ſhade, ſuch as dire ed, Page 106, and the eye frequen bathed in lukewarm water, to wash av any matter that may be formed by the more immediately affected, and to rem the discharge from the eye, which is o adhesive and irritating: the lids also they are often a good deal ſwelled, ſtimulated by the acrimony of the te may be kept moist, by ſome mild ointm

When the part, that has been burn thrown off by the efforts of the veſsels, the pain, and inflammation have ful ed, and an opacity of the *cornea* rem it must be treated in the ſame mann opacities after common inflammations.

I hope I ſhall be excused for once more peating, that when the eye has been urnt with lime, lukewarm water only ight to be applied, as none of the com-on applications made use of, to ſubdue flammations of the eye, are proper; and if ſhould be deemed neceſsary to do ſome-ing more than patiently trust to nature, d frequent ablution, it may ſurely be nsidered a very pardonable imposture, prescribe water, to which colour may be ven, by a few drops of *tinctura croci*, or nething of a ſimilar kind; that the tient may be cheated, as it were, for his n advantage.

In the town of Birmingham, where I ide, whose inhabitants are chiefly em-yed in the working of metals into a riety of articles, pieces of ſteel are often uck off their tools into the eye, and from e defence afforded the eyes by the lids, e ſteel generally pierces the *cornea*, where is either buried between its *laminæ*, or

ſticks in it, presenting a ſharp ſurface t
the irritable membrane which lines the lid

The metal, in general, is very ſmall i
quantity, forming only a minute dark ſpecl
and as, from the violence of the blow,
flies off in a heated ſtate, the *cornea*
burnt, yet from the ſmallneſs of the particl
on its being ſpeedily removed, no percept
ble opacity remains. It is always desirab
to have it immediately extracted, for thoug
if left in the eye, nature would remove
by ſuppuration, yet on that account the da
ger of its inducing an opacity, which mig
hereafter prevent perfect vision, is ve
much increased.

The method I take to extract particles
ſteel from the eye, is with a ſmall ſtraig
bladed knife, made rather thick in t
back, and not brought to a very fine poi
Taking this in my right hand, whilst w
the left I draw down the lower lid, the p
tient's head being ſupported by an aſsista

ho ſtands behind, and elevates the upper d, on the point of the knife being placed nder the particle of ſteel, it generally, on e first or ſecond attempt, is disturbed, and e point of the knife, having been pre-oufly well rubbed on a loadstone, attracts e ſteel, which is immediately removed. his knife I also find very convenient for tracting extraneous bodies of different nds, and from its form and ſtrength much eferable to a lancet. The lancet is vkward to turn about in the hand, and ving a double edge, often wounds the ges of the lids; it is alſo brought to ſo fine point, as frequently to do considerable ury to the eye.

When the ſteel has buried itself in the *rnea*, it becomes much more difficult to tract, as it will be requisite to insert the int of the knife into the ſmall aperture ade by the paſsing of the metal, and lay en the *cornea* down to it, when it will be arly in the ſame ſtate as if ſituated on the

ſurface, and muſt be extracted in the ſame manner.

If the ſteel is ſituated beyond the centre of the *laminæ* of the *cornea*, and more interiorly, towards the anterior chamber of the aqueous humour, great nicety is required in extracting it, leaſt an opening ſhould be made into the anterior chamber, the metal forced into it, and the patient lose his eye. In ſuch cases it may be best to truſt to nature, who will often ſucceed; for the practitioner would certainly be much reflected on, the patient not knowing the peculiarities of his case, if, in attempting to extract a bit of ſteel, the ſight ſhould be destroyed.

In instances of this kind, as the *cornea* in its natural ſtate is insensible, and no rough part of the ſteel rubs against the lids, no much irritation is excited, ſuppuration very ſlowly proceeds, and as it inclines to the ſurface of the body, the metal by degrees comes out with the matter.

It might, probably, be ſuppoſed, that were the particle of metal to gain admiſsion into the anterior chamber, the inflammation roduced would be ſo great as to cause a ppuration of the internal parts of the eye, nd an evacuation of the humours, and that very method ought to be tried to extract the article in the first instance.

It has already been ſhewn, in ſpeaking of e effects of blows, that the *chrystalline ns* has been confined in the anterior chamer for years, without producing much pain, nd a justly celebrated lecturer, of London, formed me, that once, in making the ſecon of the *cornea*, to extract a cataract, the oint of the knife broke, and he believes mained in the eye, though the patient covered without any unfavourable ſymp-m. The point of the instrument, hower, might never have been in the eye; it might ſpeedily have been washed away the flowing of the aqueous humour; I ill therefore relate a case, exactly in point,

wherein will be ſeen the effects of a piec of ſteel remaining in the aqueous humour.

A few years ſince, a young man came t me from the country, to have a ſomethin taken from his eye, which, he ſaid, fle into it a few days before, as he was hoein turnips. The eye was very ſlightly inflam ed, and on one ſide of the lower part of tl *cornea* was seen, what appeared to m a piece of iron, a good deal larger than usually found in ſimilar cases; the *corn* was completely healed over it, and as he d not complain of pain, I declined attemptin to extract it; gave him a mild lotion, ar desired him to come again in a week.

It was nearly a month before I ſaw hi when the inflammation of the eye w nearly the ſame as on my first ſeeing hi at times giving him a little uneasineſs; if he looked at any thing earnestly, the e in a ſhort time was filled with water: now found the extraneous ſubstance, whi

had before observed in the *cornea*, to be in he anterior chamber, a very ſhort distance rom where I had first seen it, and hanging y a ſmall filament of matter, in the aqueous umour, and waving, on the eye being oved.

On bringing a large magnet near his eye, nd moving it in different directions, the bstance obeyed its motions, ſhewing it to e iron; and though I attempted to remove , by placing the magnet in various ſituaons, and giving the particle of iron both a uick and ſlow motion, I was not able to tach it from the *cornea*.

A few weeks afterwards he called on me gain, and ſaid the eye was better, but ther weak, and thought if he could have mething to *ſtrengthen it*, he ſhould ſoon well. The eye ſtill looked ſlightly flamed, or as if it was exposed to ſome all irritation. I particularly requested would call again, but ſince that time

have never ſeen him; I conclude, from the circumſtances of the caſe, he has not experienced much inconvenience from it.

6. Eſſential oils, alkalies, acids, acrid juices, &c. are next mentioned, as exciting caufes of inflammations of the eyes. For their removal, recourse ſhould be had to frequent ablution with warm water, and on an inflammation ſucceeding, it ought to be considered, whether there has been any part destroyed, by a combination between the animal fibre and the foreign ſubstance or whether it has acted merely as a ſtimulant, and increased and diseased actions of the veſsels been induced in consequence.

In the first instance the ſame directions are applicable, as are given after the eye has been burnt with lime; but in the latter case, it must be treated the ſame as an Opthalmy, after the application of cold which will be considered in the ſecond part.

7. When an Opthalmy arises from exposure to too much light, it generally proceeds from a predisposition of the part to diseased action. The exciting cause must be avoided, and the case treated the ſame as a common inflammation.

8. The eighth cause mentioned, as producing Opthalmy, is the increased secretion of tears, especially with their confinement, to the eye.

With respect to the Opthalmy occasioned by much weeping, from mental affections, or the almoſt constant flow of tears, which attends the rubiolous eruption, I have no observations to make which are applicable to this place. It is not ſo with the inflammation of the eyes, which, more or leſs, is brought on by the eruption of the ſmall pox, when the pustules on the face are in any quantity.

A ſmall pock pustule has its margin inflamed, and ſwelled, and when the pustules are numerous, the whole external ſurface of the body is enlarged. The pustules having the effect of inflaming and enlarging the part, on which they arise, if ſituated on the eye lids, they become inflamed and ſwelled; they are closed, and in a ſhort time very firmly ſo, by an adhesive matter, discharged from the eyes. The question, then, is, whether we ought to endeavour to prevent this closing of the lids, or not.

Some, from the idea that the lids, being closed, are a great preservation to the eyes, will on no account allow them to be touched; but ſuffer the discharge to collect in considerable quantities, about the edges of the lids; whilst others, from an over officiousneſs, are almost constantly endearouring to ſeparate them, to remove the matter as it is ſecreted. Between these two practices, a due medium ſhould be

pserved. The ſwelling of the lids being e uniform effect of the pustules, cannot abated, but by the natural course of the sease, and what we ought to attempt is, at the eyes ſhould be irritated as little poſsible, and the confinement of the ars prevented. The lids ſhould be uched with the greatest gentleneſs, any atter that collects, removed with a little arm water, and the edges of the lids pt *very moist* by the application of ſome ild ointment.

The lids ſhould never be free from the ntment, that it may prevent the confinent of the acrid tears, which is generally e cause of the ſucceeding inflammation: sides, if they are kept constantly moist, ere will be no danger of *ſtrabismus*, which metimes is brought on, by the eye-lids ing partially opened, on the the decline the disease, and the patient endeavourg to ſee, through the ſmall part which mits light.

For the inflammation that is an attenda on the *fistula lachrymalis*, ſome relief m be experienced, by frequently emptying t lachrymal *ſac*, by making a preſsure o with the finger; yet its removal must be expected without the cure of the origi disease, but how, or by what means tha to be effected, would lead into by far long a discuſsion to enter upon here.

9. Erysipelatous and inflammatory aff tions of the parts adjoining the eye, the last causes mentioned, as produc Opthalmy by a direct increase of *ſtimu* The original inflammatory infection w require our first attention, and all that be done for the inflammation of the eye: to keep it cool, and as free as poſsible fr all irritating causes.

END OF PART FIRST.

Printed by Swinney and Hawkins, No. 75, High-Street, Birmingham.

OBSERVATIONS

ON THAT

DISORDER

OF THE

ORNER of the EYE,

COMMONLY CALLED

Fiſtula Lachrymalis.

By *PERCIVALL POTT*,

ior SURGEON to *St. Bartholomew's-Hoſpital.*

Neque enim credunt poſſe eum ſcire quomodo morbos curare veniat qui unde hi ſint ignoret; eum vero recte curaturum, in prima origo cauſæ non fefellerit.

A. CORN. CELSUS.

The SECOND EDITION, improved.

LONDON:

nted for L. HAWES and Co. at the *Red-Lion* in *Paternoſter-Row.* M. DCC. LXIII.

1650234

THE

PREFACE.

By frequently converſing with ſome of that part of the profeſſion who come to London *to attend the Hoſpitals, and to improve themſelves in the Art of Surgery, it has appeared to me that the* Fistula Lachrymalis, *tho' a very common diſeaſe, is one with which many of them are very little acquainted, either with regard to its cauſe, ſeat, or method of cure. Some are totally ignorant of every thing relating to it, others who have an imperfect idea of its nature, and ſeat, are yet much at a loſs how to vary the method of treating it according to its different ſtates and circumſtances;*

upon which diſtinction the probability of a cure does often in great meaſure depend; for if thoſe means which are only proper in one ſtate of the diſeaſe are uſed in another, the patient will be fatigued to no purpoſe, and the ſurgeon by being frequently diſappointed will be inclined to think thoſe caſes incurable, which have only failed through his own miſmanagement.

THERE *is hardly any chirurgical diſorder which requires a more cloſe regard to all its appearances and variations than this does; and whoever expects to conduct it ſucceſsfully, muſt attend to it conſtantly: this is, perhaps, the great reaſon why it is ſo little underſtood; the object is too minute, and the proceſs often too long to engage the attention; beſides which, it hardly comes under the name of an operation, the great and almoſt only object which they who come hither from the diſtant countries have in view: the operative part of ſurgery is what they*

have ſeen the leaſt of, and therefore they are the more deſirous of becoming acquainted with it; this deſire is a very laudable one, and ought certainly to be encouraged, but ſtill the operative part of ſurgery is far from being the whole of it; and I cannot help thinking, that by attending a little more to what is called common or practical ſurgery, our art might ſtill be conſiderably improved, practitioners rendered more expert, and mankind much benefited.

THE *merely curing diſeaſes is not all; that was done (ſooner or later) while ſurgery and anatomy were in their moſt imperfect ſtate, and while every branch of medicine laboured under many inconveniences which are now happily removed; but the different methods in which chirurgical diſorders are treated, or their cures attempted, will make ſo conſiderable a difference in the confinement and ſufferings of the patient, as to be very well worth attending to.*

IT

It *may possibly be thought foreign to my present purpose, but I cannot omit this opportunity of adding a few words on a subject which appears to me highly deserving of some notice, as its influence may be very extensive and very prejudicial; it is the false idea which the by-standers at an operation generally have of chirurgic dexterity; to which word they annex no other idea than that of quickness. This has produced a most absurd custom of measuring the motion of a surgeon's hand, as jockeys do that of the feet of a horse,* viz. *by a stop-watch; a practice which though it may perhaps have been encouraged by operators themselves, must have been productive of most mischievous consequences.* Tute et celeriter *are both very proper characteristics of a good chirurgic operation; but* tute *stands as it should do, in the first place, and the patient who suffers the smallest injury from the hurry of his operator has no recompence from the reputation which the latter obtains*

from

pital operations unforeſeen circumſtances will ſometimes occur, and muſt be attended to; and he, who without giving unneceſſary pain from delay, finiſhes what he has to do in the moſt perfect manner, and the moſt likely to conduce to his patient's ſafety, is the beſt operator.

I have endeavoured to make the following tract as plain and as intelligible as I can; and if it ſhould appear prolix to thoſe who are already acquainted with the ſubject, I muſt beg leave to obſerve, that it was not written for their information; but if any of thoſe who were unacquainted with it before ſhould from hence gain any uſeful knowledge, my end will be anſwered, and I ſhall be very much pleaſed.

OF THE

Fiſtula Lachrymalis.

SECT. I.

THE antient writers were in general ſo little acquainted with the anatomical ſtructure of the parts concerned in this diſeaſe, that both its cauſe, and ſeat have been very erroneouſly repreſented by moſt of them; other diſorders, very different both from this and from each other, have been confounded under the ſame general appellation, and the means made uſe of toward obtaining a cure, being adapted to ſuch miſconceptions, were rough, painful, and moſt commonly ineffectual.

THE fluid which perpetually moiſtens the eye, was ſuppoſed to be ſecreted by

now called the caruncle, and to flow from thence upward thro' the puncta lachrymalia *. The caruncule was by many thought to be the ſeat of the diſeaſe in queſtion, which was ſaid to be produced, either by a defluxion from the brain † on this part, or by an abſceſs formed within the body of it; or by a lodgment of the tears, become acrid and corroſive in conſequence of ſuch ſtagnation ‡; while others looked

* FALLOPIUS, who has very accurately deſcribed the puncta lachrymalia. ſacculus, and duct, as well as the diſeaſe, has yet fallen into this common error. "Ad oculos ipſos "ex faucibus egrediens venio, in quibus primum præter "miſere anatomici duo foramina parva in angulo interno "poſita, quarum unum eſt in palpebrâ ſuperiori, alterum "in inferiori, in viventibus adhuc hominibus, ſi quis inſpi "cere voluerit apparentia, quæ foramina habent meatus qui "ſub carunculâ encanthidos vel epicanthidos dicta uniuntur "in quendam communem ſinum in narium cavitatem deſi "nentem per canalem proprium in oſſe ſquamoso, quod in "ternum angulum occupat inſculptum.

"PER hos meatus major lachrymarum pars ut ego in fle "bus mulierum obſervavi, ad oculos emanat."

FALLOPIUS.

NON enim os ſolummodo carioſum, verum etiam glandula ita eroſa erat, ut quotieſcunque puer ploraret lachrymæ per ipſam fiſtulam copiosè extillarent. HILDANUS.

† FISTULA lachrymalis fit ex humorum decurſu, qui currunt ad lachrymalis angulum juxta naſum, nec propter eorum multitudinem, et groſſitiem poſſunt exire, &c. hi autem morantes ibi diutius corrumpuntur, et locum ulcerant.

LANFRANC.

ÆGYLOPS eſt tumor abceſſorius inter majorem angulum, et nares proveniens. PAULUS.

‡ AT the great corner of the eye there is a glandule made for receiving and containing the moiſture which ſerves for lubricating

looked upon it as a kind of encyſted tumor. The ſwelling in the inner corner of the eye, the frequently attendant ophthalmy, the involuntary flux of ſerum down the cheek, the excoriation of the eye-lid, and the diſcoloured diſcharge upon preſſure, ſtrengthened their opinions, and confirmed their prejudices.

They who ſuppoſed it to be cauſed originally by a defluxion of the inflammatory kind, tending to produce an abſceſs, had recourſe at firſt to thoſe general methods and means which were thought moſt likely to prevent ſuch conſequence: theſe not anſwering, they proceeded to open the ſuppoſed abſceſs, and to endeavour the digeſtion of it; on the other hand, they who ſuppoſed it to be an encyſted tumor attempted the eradication of it, either by knife, cauſtic, or cautery; and all of them taking it for granted when the diſcharge

 was

ubricating the eye; this glandule, ſometimes by a ſanguine or pituitous defluxion falling violently from the brain, wells and impoſthumates, and ulcerates, &c. Amb. Parey.

Hæc caruncula ab acrium humorum affluxu turget nonunquam intumeſcit, et abſcedit ulceraturque, ulcere non raro in fiſtulam abeunte adeo ut ſubjectum os corrumpatur: Munnicks.

Per puſillum utriuſque palpebræ foramen lachrymæ naturaliter effluunt. Fab. ab Aquapendente.

Lachrymæ veniunt per lachrymalia a foramine quodam parvo, et quaſi inſenſibili in fine pilorum. Guido.

was apparently purulent, or much discoloured, that the bone was rotten, advised the use of escarotic applications, or the hot iron to destroy the callosity, and to dry and exfoliate the caries; and these methods failing, as in the nature of things they very frequently must, they pronounced the disease to be incurable.

A MORE minute and careful examination into the anatomy of the parts has given us a more true idea of the disorder, and furnished us with a more rational, as well as a more successful method of treating it. We now know, that the caruncule is not the organ which secretes the tears, but that this office is performed by a gland, situated near the outer corner of the eye; that the lachrymal fluid is in its nature perfectly innoxious; that an obstruction in the nasal duct is most frequently the primary and original cause of the complaint; and that its seat is in the sacculus lachrymalis.

UPON these principles the modern practitioners have, with great industry and ingenuity, endeavoured to find out some means, whereby this obstruction may be removed, and the parts restored to their natural and healthy state, without such pain

destruction.

deſtruction, and deformity, as the antient methods occaſioned; or, theſe failing, to eſtabliſh a new artificial paſſage, which may in ſome meaſure ſupply the place of the natural one.

All theſe means have the merit of being founded on the natural ſtructure of the parts concerned: when the more eaſy, and mild ones ſucceed, the patient gains a conſiderable advantage; and when they do not little time is loſt, nor is any more efficacious method rendered thereby leſs practicable: in this, as in every other part of ſurgery, the more ſimple means ought to be firſt tried, pain ſhould be avoided as much as poſſible, except when abſolutely neceſſary, and then it muſt be ſubmitted to.

SECT. II.

THAT the motions of the eye-lids may be performed with the utmoſt eaſe, that the tunica cornea may be kept conſtantly clean, bright, and fit for the tranſmiſſion of the rays of light, and that duſt, and other hurtful particles, may be immediately

immediately washed away, the surface of the eye is continually moistened by a fine limpid fluid.

This fluid is derived principally from a large gland, situated under the upper edge of the orbit, near the outward corner of the eye, which gland is of the conglomerate kind, and lies in a small depression of the os frontis; its excretory ducts, or those by which it discharges the secreted fluid, piercing the tunica conjunctiva, just above the cartilaginous borders of the upper eye-lids.

While the caruncule was thought to be the secretory organ of the tears, this gland bore the title of glandula innominata; but now that its use and office are known, it is called glandula lachrymalis.

By irritation from any sharp or poignant particles, a large quantity of this fluid is immediately secreted, and by the motion of the eye-lids is as immediately derived over the surface of the eye, by which means such particles are washed and wiped off. Sometimes also the passions of the mind produce an immediate increase of this

perly, called tears; a conſtant ſecretion of too large a quantity cauſes a diſeaſe, called epiphora; and a deficiency of it makes the motions of the lid difficult and painful.

ALTHOUGH the fluid ſecreted by the lachrymal gland is conſiderable in quantity, yet, when it is not ſuddenly produced by irritation from without, or paſſion within, it is ſo conſtantly and gradually carried off, as to create neither trouble, uneaſineſs, nor blemiſh.

THE edge, or border of each eye-lid, is formed by a thin cartilage, the figure and conſiſtence of which keep the lids properly expanded; theſe cartilages are covered by a fine membrane, and are called cilia, their internal edges, do, upon every motion, ſweep over every point of the ſurface of the cornea; this motion, tho' almoſt imperceptible, unleſs attended to, is very frequently performed, and as the ſecretion of the fluid is alſo conſtant, the eye is by this means kept always moiſt, clean, and bright.

AT

At the extremity of each of theſe cartilaginous borders of the eye-lids, on the ſide next the noſe, is a ſmall papilla, or eminence; and in the middle of each of theſe is a ſmall hole, or perforation, which being made in the cartilage is not liable to collapſe while the parts are in a ſound ſtate, but remains always open; they are called the puncta lachrymalia, and their office is to receive the lachrymal fluid, as it runs off the cornea along the edges of the eye-lids, thereby preventing it from trickling down the cheek; and that there may be no impediment to the conſtant execution of this office, during the time of ſleep, as well as that of being awake, the internal edges of the cilia do not come into immediate contact with each other in that point where theſe orifices are.

From each of theſe puncta lachrymalia proceeds a ſmall membranous tube, which tubes ſoon enter into, or form a pouch or bag, ſituated near the inner angle of the eye, juſt below the union of the two lids, under the muſculus orbicularis palpebrarum; the bag is called the ſacculus lachrymalis, and its office is to receive all the

lymph

the upper part of this ſacculus lies in an excavation, formed partly by the naſal proceſs of the os maxillare ſuperius, and partly by the os unguis; the lower part of it is confined in a long channel, and forms a tube, or duct, which deſcending obliquely backward, communicates with the cavity of the noſe, behind the os ſpongioſum ſuperius, by an opening whoſe ſize is ſomewhat different in different ſubjects.

THIS paſſage is called the ductus ad nares, or the ductus naſalis, and thro' it, whatever is received by the ſacculus from the puncta does, in a healthy and ſound ſtate of theſe parts, paſs into the noſe.

THE membrane which lines this ſacculus and duct, is in its ſtructure much like to the membrana pituitaria narium, from the ſurface of which a clear viſcid mucus is ſecreted, and by which the ſacculus and paſſages are conſtantly moiſtened and kept pervious.

WHILE the parts are in a healthy, ſound ſtate, the fluid ſecreted by the lachrymal gland paſſes off thro' the puncta, ſacculus,

ble, but when they are in a diſeaſed ſtat the caſe is otherwiſe ; this membrane, lik all other vaſcular parts, is liable to inflam mation, by which means it often hap pens, that it is ſo thickened as to obſtruc the naſal duct, and thereby much impede or totally hinder the paſſage of any thin thro' it, in conſequence of which ob ſtruction the ſacculus is filled by its natu ral mucus, and the derivation of the ſerun from the lachrymal gland thro' it bein thus prevented, it runs off from the eye lid down the cheek ; this obſtruction con tinuing, and the mucus ſtill lodging, th ſacculus is dilated, and produces that tu mor in the inner corner of the eye, an that diſcharge, upon preſſure, which cha racterize the firſt ſtate of the diſeaſe i queſtion, and, in conjunction with ſeve ral other attending ſymptoms, prove i ſeat to be in the lacrymal ſac, and naſa duct.

SEC

SECT. III.

ALTHO' the ſeat of this diſeaſe is the ſame in almoſt every ſubject, et its appearance is very different in dif-erent perſons, and under different cir-umſtances; theſe variations depend prin-ipally on—

1. THE degree of obſtruction in the aſal duct.

2. THE ſtate of the cellular membrane overing the ſac.

3. THE ſtate of the ſacculus itſelf.

4. THAT of the bone underneath.

5. THE general ſtate and habit of the atient *.

SOMETIMES a ſerous kind of defluxion, which the lining of the ſac and duct e ſo thickened as to obſtruct, or prevent e paſſage of the fluid thro' them into

 the

* As the ſtate and circumſtances of this diſeaſe are really ous, and differ very eſſentially from each other, the ge-al cuſtom of calling them all by the one name of fiſtula rymalis is abſurd.

the nose, makes the whole complaint, and the cellular membrane on the outside no being diseased, there is no appearance o inflammation; in this case the duct i stopped, and the sacculus dilated, bu without any alteration in the colour of th skin, a fulness appears in the corner of th eye next to the nose, and upon the appli cation of a finger to this tumor, a clea viscid mucus is discharged thro' the punct lachrymalia, the patient feels no pain, no finds any inconvenience, except what i produced by the discharge of this mucus and by the trickling of the lymph dow the cheek.

In some cases the mucus is not perfectl and always clear, but is sometimes cloudy and looks as if it had a mixture of milk c cream in it, at first waking some of it i generally found in the corner of the eye and the eye-lashes being smeared over wit it during sleep, most commonly adhere to gether in the morning.

This is the most simple state of the dis ease, what the French have called the her nia, or hydrops sacculi lachrymalis; it i frequently met with in children who hav

bee

been rickety, or are subject to glandular obstructions, and in this state it sometimes remains for some years, subject to little alterations, as the health or habit shall happen to vary, the sacculus being sometimes more, sometimes less full, and troublesome, the mucus which is pressed out sometimes more, sometimes less cloudy, and now and then attended with a slight ophthalmy, or an inflammation of the eyelids, but which, by common care, is easily removed.

If the sacculus is not much dilated, the discharge small, and produced only by pressure, the chief inconveniences are the weeping eye, and the gumming together of the lids, after sleeping; but these, by being attended to, may be kept from being very troublesome, and if the disease makes no farther progress, may be so regulated as to render any more painful process totally unnecessary.

If the dilatation is considerable, the swelling is more visible, and the quantity of mucus is larger; it is also in this state more frequently mixt and cloudy, and more

more troublesome, from the more frequent necessity of emptying the bag; but if the patient be adult, it may, even in this more dilated state of it, be kept from being very inconvenient.

If an inflammation comes on, the tumor is thereby considerably increased, the discharge is larger, as well during sleep, as upon pressure, the skin covering it, loses its natural whiteness and softness, becomes hard, and acquires an inflamed redness, and with the mucus a mixture of something, which in colour resembles matter, is discharged, especially if the pressure be made with any force, or continued for any time: this circumstance, added to the painful sensation, and inflamed appearance of the parts, has been productive of a supposition, that in this state there is either an ulcer, or an abscess within the sacculus or duct.

As this is an opinion, which tho' it may possibly sometimes have some foundation in truth, yet is in general entertained much too hastily, and is also the principal source whence most of the mistakes concerning this disease have sprung, I would beg leave

leave to be indulged in a few words on this ſubject.

It has already been obſerved, that from the ſurface of the membrane which lines theſe parts, a thin mucus is ſecreted, by which its ſurface is ſmeared over, in the ſame manner as is that of all the membrane which covers or lines the fauces, larynx, and internal parts of the noſe, the antra of the jaws, and the ſinus's of the ſphenoid and ethmoid bones, *&c.* While the lachrymal ſac is free from diſeaſe, and the ductus ad nares open, this mucus is nearly limpid in colour, ſmall in quantity, and paſſes inſenſibly into the noſe with the fluid from the lachrymal gland; but when, by the obſtruction of the naſal duct, that paſſage is denied, it neceſſarily lodges in the ſacculus, by diſtending and irritating its containing bag, it is increaſed in quantity, altered in colour, and diſcharged at the puncta lachrymalia, as it either becomes too much for the ſac to contain, or as it is forced out by preſſure. This is a ſhort and ſuccinct account of the true nature of the diſeaſe, and ſuch as will fairly and truly account for all its ſymptoms and appearances, without having recourſe to

very ſeldom, if ever, attend it.

THAT which is mixed with the clearer part of the mucus, and which from its pale yellow hue is taken for matter, is not matter, but mucus, which in this part, as well as ſeveral others in the body, does, either by being confined beyond the neceſſary time, or by inflammation, or irritation of the gland or membrane which ſecretes, or contains it, or even from general affection of the habit, put on a yellow, purulent colour, when there is neither abſceſs, nor ulcer in the part whence it comes.

So many inſtances of this are producible as to put the matter beyond all doubt, the urethra, vagina, and all the ſinus's of the head which communicate with the noſe, furniſh us with them daily; the linings of all theſe are conſtantly imbued with a mucus naturally clear, and no more in quantity, than is neceſſary to keep the membranes moiſt, but either inflammation or irritation does immediately ſo add to its quantity, and ſo alter its colour, that in the two former, the ſame miſtake has often been made as in the ſubject in queſtion, that

is,

purulent, and produced by ulceration of the parts.

Thefe two fluids pus and mucus, which have been fo frequently confounded together, do really differ fo widely from each other in their nature, conftitution, fources, purpofes, and effects, that to diftinguifh them properly, and to point out the true character of each, feems to be a matter of much importance; it would carry me too wide from my prefent purpofe to attempt it in this place, and therefore I fhall only juft mention what may ferve merely to illuftrate that.

If I conceive rightly of this affair, mucus, confidered in a general fenfe, is the effect of a natural fecretion made by glands, membranes, or other bodies appointed for that purpofe, and is fo far from being originally the confequence of difeafe, that, in a due quantity, it is abfolutely neceffary for feveral very important purpofes in the animal œconomy, which purpofes, when this fluid is deficient, muft be ill-executed, and fome kind of difeafe, or defect follow: whoever will reflect on the ufes of it

ſulæ, of the tendons, in the ſinus's of the ſkull ſerving the purpoſes of ſpeech, in the cavity of the noſe where the olfactory nerves do their duty, in the proſtate gland, larynx, trachea, urethra, and vagina, will be eaſily convinced of the truth of this aſſertion, both with regard to its natural uſes in a healthy ſtate, and proper quantity, and the ſhare it frequently has in the production of diſeaſes, when it is either vitiated or redundant.

Pus, or matter, is certainly no natural ſecretion; ſuppuration, tho' it is an act of nature when ſome parts of the body have been forcibly divided from each other, is nevertheleſs to be regarded as the effect of violence and deſtruction, at leaſt of diviſion; for, without entering minutely into the origin or nature of it, I believe, I may venture to affirm, that the diſſolution of ſome of the ſolid particles of broken capillary veſſels, and a mixture of ſome part of the juices which ſhould circulate thro' them, make a neceſſary part of its production; however conſtant its appearance may be in the progreſs toward healing a wound, or ſore, yet it never

never is produced, even in the ſmalleſt quantity, without ſome degree of eroſion, ſome breach in the natural ſtructure of the parts, and when ſuch breach is healed the diſcharge neceſſarily ceaſes.

On the contrary, mucus may by irritation, relaxation, or defluxion, on its ſecreting or containing parts or organs, be increaſed to a quantity far beyond what is neceſſary or uſeful, and produce thereby a diſeaſe in parts where there is not the leaſt degree ſolution of continuity, as in the caſes of teneſmus, ſtone in the bladder, fluor albus, and ſimple gleets from the urethra; as alſo in that kind of defluxion on the noſe and fauces, producing a catarrh, and in the immediate effect of all ſternutatories.

Other differences between the nature and properties of the two fluids might be mentioned, but if theſe already cited are juſt, they will be ſufficient to evince the impropriety of confounding them together, either with regard to theory or practice.

Nor is this miſtake of diſcoloured mucus for matter confined to the lacrymal ſac

only; the two circumſtances of pain, and yellow colour, having, in almoſt all times, produced the ſame miſconception in the virulent gonorrhea of both ſexes; this has been called pus, and being ſaid to proceed from ulcerations in the urethra and vagina, tho' the repeated teſtimony of thoſe who have, immediately after death, examined the parts of perſons ſo diſeaſed, has often been produced to the contrary; and tho' the diſcharge itſelf, when properly examined, will always prove the contrary; inflammation and irritation of the membranous linings of the urethra, and vagina, will fully account for all the appearances in this diſeaſe, in which there is neither matter, nor ulcer, nor abſceſs: whoever will attend to the diſcharge made from a purulent ulcer, will find it widely different from that which iſſues from either of the above parts in a gonorrhea.

Again, in caſe of ſtrictures in the male urethra, the diſcharge occaſioned by a bougie, properly and judiciouſly uſed, is a diſcoloured mucus, and not matter, tho' it is generally ſo called; it is from the diſcharge of this mucus, and the dilatation of the paſſage, that the relief is obtained, not

from

from any deſtruction or diviſion of parts; the bougie, which produces true matter, does much more harm than good, makes a ſore where there was none, and where there ought to be none; how often do catarrhous defluxions on the trachea, and larynx, wear toward the cloſe a deep purulent colour, ſo as to deceive the unknowing into an opinion, that it is matter from the lungs? But no judge of theſe things ever had recourſe to abſceſſes or ulcers for a ſolution of ſuch appearance. The argument drawn from the quantity of theſe diſcharges is as erroneous as thoſe taken from its colour; as an inflammatory defluxion on the part does generally occaſion the latter, ſo meer irritation will produce the former, which does alſo generally ceaſe when the irritating cauſe is removed or appeaſed: how immediately is a moſt troubleſome teneſmus cured by a glyſter of ſtarch and opium? What large fœtid diſcharges are made from behind the prepuce of many perſons, not only free from all venereal teint, but without any ulceration of the parts, by a kind of exſudation? To what length of time will they not continue, if neglected, and how immediately do they ceaſe by the uſe of a ſpiritu-

ous

ous or vitriolic wash? How often is the fluor albus, even in some of its worst circumstances, moderated, not to say cured, merely by washing away the acrid mucus, which lodging in the rugæ of the vagina, continually irritated the parts to a fresh discharge, and perpetuated the disease? What quantity of slime is there in the urine of those who have a stone in the bladder? And how totally does it cease, upon that stone being discharged, or taken away? Whereas neither cleansing of parts, nor removal of irritating bodies, does, or ever can procure an immediate cessation of a discharge of true matter, which being occasioned by a solution of continuity, an erosion or division of the parts whence it proceeds must decrease gradually, and at last can only cease by such part becoming whole again.

In short, the two fluids are so absolutely different and distinct, that the blending them together in our ideas of disease, proceeding from, or producing either of them, cannot be too industriously avoided; it is a subject on which a great deal more might be said, as it would comprehend, or have relation to many disorders, which perhaps are

to; but being beſide my preſent purpoſe, I ſhall ſay no more about it, only deſire, that I may not be miſunderſtood, as if I meant to aſſert, that there never is abſceſs or ulcer in the lachrymal ſac, and duct: No, I only mean to ſignify, that it is my opinion, that the yellow, or purulent colour of the diſcharge, which is generally received as a proof of ſuch, is no proof at all; that this colour may be, and moſt frequently is, dependent on other cauſes; that tho' by the ſuppuration of the cellular membrane covering the ſac, the upper part of it ſometimes becomes ſloughy, and burſts, yet the lower part of it, and the naſal duct, are often at the ſame time perfectly ſound; and that there never is abſceſs or ulcer within, while the ſkin is entire and preſerves its natural hue, and ſoftneſs, let the colour of the diſcharge be ever ſo yellow; circumſtances of no ſmall conſequence in the treatment of this diſeaſe.

The inflammation of the cellular membrane covering the ſac, is a circumſtance which makes a conſiderable difference, both in the appearance of the diſeaſe, and

in

is confined merely to the ſurface of the tumor in the corner of the eye; in others it ſpreads ſtill farther, affecting the eye-lids, cheek, and ſide of the noſe.

When the parts are in this ſtate, the mucus within the bag has generally the appearance of being matter, that is, it wears a deep yellow colour, and is of a more thin conſiſtence; if the puncta lachrymalia are naturally large and open, and the inflammation confined to the ſurface of the ſac, its contents will paſs off pretty freely, and the ſkin will remain intire; this is what the antients called the ſimple, or imperfect, or anchylops.

But when the ſkin covering the lachrymal bag has been for ſome time inflamed, or ſubject to frequently returning inflammations, it moſt commonly happens, that the puncta lachrymalia are affected by it, and the fluid not having an opportunity of paſſing off thro' them, diſtends the inflamed ſkin, ſo that at laſt it becomes ſloughy, and burſts externally. This is that ſtate of the diſeaſe which is called perfect, Aigylops, or Ægylops;

thro' the puncta lachrymalia, while the ſkin was intire, is now made thro' the new opening, and by excoriating the eye-lids and cheek increaſes the inflammation, and gives the diſeaſe a much more diſagreeable appearance. In ſome the matter burſts thro' a ſmall hole, and after it has diſcharged itſelf, the tumor ſubſides, the neighbouring parts become cool, and tho' the ſkin covering the ſurface of the ſacculus is ſloughy and foul, yet there is no reaſon to believe that the ſac itſelf is much diſeaſed below; in others the breach is large, the ſkin remains hard and inflamed, and from the appearance of the ſore, there is reaſon to ſuppoſe the whole inſide of the bag to be in a diſeaſed ſtate; and in ſome caſes, which have been much neglected or irritated by ill-treatment, the cavity of the ſacculus ſeems to be filled with a looſe ill-natured fungus, which gleets largely, and produces inflammation and excoriation of all the parts about.

THERE is alſo another circumſtance which ſometimes is found to attend this diſorder, viz. a carious ſtate of the bones; this was by our forefathers ſuppoſed to be

ſon for their ſo free uſe of cauſtic, cautery and ſcalpra, in the treatment of it; but ſince the diſeaſe has been more minutely examined into, this circumſtance has been found to be a very rare one. When the fiſtula lachrymalis is a ſymptom of the lues venerea, as it ſometimes is, the bones are indeed often carious, but then, the fiſtula is not the original complaint, but produced ſecondarily, and is a conſequence of the diſeaſed ſtate of the os ethmoides, and oſſa ſpongioſa of the noſe, and is not curable by any local means or applications, but depends intirely on the cure of the diſeaſe, of which it is a ſymptom.

I HAVE alſo ſeen an abſceſs after the ſmall-pox, which by falling on the lachrymal bag, has made it all ſlough away, and leave the bones bare, which circumſtance I have alſo ſeen attend the free uſe of ſtrong eſcarotics applied to deſtroy what is called the cyſt, but without the acceſſion of ſome other diſorder producing it, or the moſt abſurd method of treating the complaint; I believe that a caries of the bones will very ſeldom be met with. Indeed the combination of other diſeaſes, either of the general habit, or affecting the

ſame,

ſame, or the neighbouring parts, does often make a very material difference, both in the appearance of the diſorder, in the prognoſtic, and in the proper method of treating it, which therefore ſhould always be enquired into; for inſtance, the patient is ſometimes ſubject to an habitual ophthalmy, or a lippitudo, which will add to the deformity, and give a good deal of additional trouble during the cure; an ozæna, or ſome other diſeaſe of the membrane, and cells of the ethmoid bone, or a polypoſe excreſcence within the noſe, are now and then combined with it; the habit is ſometimes, (as I have before obſerved) infected with the lues venerea, of which this diſeaſe may be a ſymptom; ſtrumous glandular obſtructions are its too frequent companions, and what is worſt of all, it is ſometimes cancerous.

SECT. IV.

FROM what has been ſaid, I think it will appear that this diſeaſe, in its primary and moſt ſimple ſtate, conſiſts in a retention or lodgment of mucus in the ſacculus lachrymalis, in conſequence of an

obſtruction of the natural paſſage from tha bag into the noſe; that by means of thi lodgment the ſacculus is diſtended, irritated, and ſometimes inflamed; that the fluid which paſſes from the lachryma gland over the eye to the puncta lachrymalia, being prevented by the fulneſs o the ſac from getting into it, runs down the cheek, and therefore that the characteriſtic marks of the diſorder, when recent, are a ſmall tumor in the inner corner of the eye, an involuntary flux of ſerum down that ſide of the face, and a diſcharge o mucus thro' the puncta lachrymalia upon preſſure.

This lodgment, being originally produced by the ſtoppage of the natural duct, it follows, that the firſt curative intention, is the removal of that obſtruction; which is ſometimes practicable, but more often not; the degree of obſtruction, its date, the ſtate of the adjacent parts, and ſome other circumſtances rendering it more or leſs ſo in different ſubjects.

That the inexperienced practitioner may be guarded againſt giving a haſty prognoſtic, or making attempts, which however

however fatiguing to the patient, muſt in the end prove fruitleſs; and that he may be enabled to underſtand the diſeaſe more perfectly, I ſhall take the liberty to divide it into four general heads, or ſtates, under which all its leſſer diſtinctions may be comprehended.

The firſt conſiſts in a ſimple dilatation of the ſacculus, and obſtruction of the naſal duct, diſcharging, upon preſſure, a mucus either quite clear, or a little cloudy, the ſkin covering the bag being intire, and perfectly free from inflammation.

In the ſecond, the tumor is ſomewhat larger, the ſkin which covers it, is in an inflamed ſtate, but intire, and the diſcharge made thro' the puncta lachrymalia, is of a pale, yellow, or purulent colour.

In the third, the ſkin covering the ſacculus is become ſloughy, and burſt, by which means the ſwelling is in ſome meaſure leſſened; but the mucus, which while the ſkin was entire, uſed to be preſſed out thro' the puncta lachrymalia, now diſcharges itſelf thro' the new aperture; the ductus ad nares, both in this and the preceding

By the improper uſe of medicines of the latter kind, it frequently happened that the ſkin became inflamed, and burſt, the diſcharge which neceſſarily followed this accident, together with the heated appearance of the parts about, confirmed their opinion of a collection of matter within, and according to ſuch ſuppoſition, they attempted to obtain a cure by dilating the orifice, and endeavouring to make an incarnation from the bottom of the hollow; not being acquainted with the ſituation, or uſe of the naſal duct, they took no care to free it from the obſtruction under which it laboured, but dreſſing the ſore like a common impoſtumation, permitted it either to be filled up with a looſe fungus, or to contract itſelf to a narrow fiſtulous orifice, which daily diſcharging a diſcoloured kind of fluid, and not healing by ſuch means as they made uſe of, they concluded the bone underneath was carious, and made way down

I believe no one will venture to ſay, that the nature and ſeat of the diſeaſe is more or better explained by what the Doctor has ſaid, than by the Serjeant; and I think it is perfectly clear, that neither of them had any true idea of it at all, they both miſtook the caruncle for the lachrymal gland, and the diſeaſe for an encyſted, or a ſcrophulous tumor, which ought to be brought to ſuppuration; the lachrymal ſac, the ductus ad nares, their uſe, and the diſorder of them creating the complaint in queſtion, they were totally unacquainted with.

with a cutting inſtrument, or by deſtroying them with cauſtic, and cautery, intending to procure an exfoliation, and thereby a firmer baſis to heal on *.

But ſince the uſe of the ductus naſalis has been known, ſince it has been diſcovered that an obſtruction in this, is the primary and principal cauſe of the diſorder, and that what paſſed for the cavity of an abſceſs is really the ſacculus lachrymalis, both the intention of cure, and the means, have been conſiderably altered.

In the firſt and moſt ſimple ſtate of the diſeaſe, viz. that of mere obſtruction, without inflammation, much pains have been taken to reſtore the parts to their natural ſtate, and uſe, without making any wound or diviſion at all; the introduction of a probe, the injection of a fluid, and a

 conſtant

* Humulo ſummum ejus foraminis excipiendum, et totum id cavum ſicut in fiſtulis dixi, uſque ad os excidendum. Celsus.

Corpus id quod inter angulum uſque ad abceſſum eſt excoluimus et carnes e profundo educimus; quod ſi igitur per ſumma ruptus fuerit abſceſſus, totum id quod eminet uſque ad os excidendum. Paulus.

Si vero per hæc medicamenta non curetur, aut recedivaret poſtea, ſignum eſt quod os eſt corruptum de ſubtus quare, tunc oportet locum detegi et os corruptum removeri. Lanfranc.

of the ſacculus in the corner of the eye, are the principal means by which this has been attempted.

Some few years ago M. Anel made a probe of ſo ſmall a ſize as to be capable of paſſing from the eye-lid into the noſe, being introduced at one of the puncta lachrymalia, and paſſing thro' the ſacculus and duct; with which probe he propoſed to break thro' any ſmall obſtruction, which might be found in its paſſage.

He alſo invented a ſyringe whoſe pipe is ſmall enough to enter one of the puncta, and by that means to furniſh an opportunity of injecting a liquor into the ſacculus, and duct; and with theſe two inſtruments he pretended to be able to cure the diſeaſe whenever it conſiſted in obſtruction merely, and the diſcharge was not much diſcoloured. The firſt of theſe, viz. the paſſage of a ſmall probe thro' the puncta, has a plauſible appearance, but will, upon trial, be found very unequal to the taſk aſſigned; the very ſmall ſize of it, its neceſſary flexibility, and the very little reſiſtance it is capable of making, are manifeſt deficiencies in

in the inſtrument; the quick ſenſation in the lining of the ſac, and duct, and its diſeaſed ſtate, are great objections on the ſide of the parts, ſuppoſing that it was capable of anſwering any valuable end, which it moſt certainly is not.

THAT the paſſing a fine probe from one of the puncta lachrymalia into the noſe is very practicable, I know from experience, but I alſo know from the ſame experience, that the pain it gives, and the inflammation it often excites, are much greater than any benefit which does or can ariſe from it.

IT is ſaid that the principal uſe of this probe is to clear the little ducts leading from the puncta into the ſacculus, and the obſtruction of thoſe ducts is often mentioned as a part of this diſeaſe, by which one would be led to ſuppoſe that it was a circumſtance which frequently occurred, whereas it is ſeldom if ever met with, and when it does happen, can never produce the diſeaſe in queſtion, the principal charaſteriſtic of which, is a diſcharge into the inner corner of the eye upon preſſure made in the angle; this diſcharge is made from the ſacculus, thro' the puncta, and proves

that the latter are open; the paſſing a probe therefore thro' theſe ſeems to be perfectly unneceſſary, ſince a ſtoppage of them would never give riſe to that diſeaſe, which conſiſts in an obſtruction to the paſſage of any thing from the ſac into the noſe, and not from the eye into the ſac.

The ſyringe, if uſed judiciouſly while the diſeaſe is recent, the ſac very little dilated, and the mucus perfectly clear, will ſometimes be found ſerviceable; I have uſed it where, I think, it has been much ſo; I have by means of it injected a fluid thro' the ſacculus into the noſe, and in two or three inſtances have effected cures by it, but I have alſo often uſed it ineffectually; it gives no pain, and a few trials render the uſe of it very little troubleſome.

Fabricius ab aquapendente invented an inſtrument, which was ſo contrived, as by means of a ſcrew to make a preſſure externally on the lachrymal bag, from the uſe of which, he ſays, his patients received much benefit; this inſtrument has been conſiderably improved by late practitioners, and is ſtill recommended as very uſeful.

All

All the good that can be obtained by compreſs, and bandage, this ſcrew is capable of procuring; but it is alſo ſubject to all the ſame inconveniences, ariſing from the impoſſibility of determining exactly the due degree of preſſure, for if it be ſo great as to bring the ſides of the upper part of ſac into contact, all communication between it and the puncta will be thereby ſtopt; if it be but ſlight, the accumulation will not be prevented, nor does it in either caſe contribute to the removal of the obſtruction in the naſal duct, the primary and original cauſe of the diſeaſe.

If the curative intention was to procure an union of the ſides of the ſacculus, as in the caſe of parts ſeparated from each other by the formation of matter or ſloughs, and the preſſure could be made uniformly and conſtantly, poſſibly it might be ſo managed as to anſwer a valuable purpoſe; but as that is not the intention, the preſſure, whether made by an inſtrument, or by a common roller, and compreſs, contributes little or nothing toward a cure, nor did I ever ſee one effected by it, altho' I have ſeveral times tried both.

That

THAT ſome ſlight obſtructions of the naſal duct have gone off while the compreſſion has been uſed, I do not deny, but am in great doubt concerning the ſhare which it had in removing them, having ſeen more than one inſtance of a cure being obtained by the uſe of a proper regimen and medicines, in ſlight and recent caſes, where nothing was uſed externally but a vitriolic collyrium; and having been always diſappointed in my attempts by mere bandage of any kind.

BESIDE theſe means of attempting a cure without inciſion, the gentlemen of the French Academy have favoured us with ſome others, ſuch as, the introduction of a probe into the lower part of the naſal duct within the noſe, the injection of a fluid by the ſame orifice, the paſſing a ſeton from the punctum lachrymale ſuperius thro' the ſacculus and duct and out at the noſtril, there to remain 'till the cure is compleated; and for thoſe purpoſes they have invented and given figures of a number of probes, ſyringes, and many other inſtruments which, they ſay, have been very ſucceſsfully uſed; far be it from me to ſay that

they

trying thofe, or any other means by which mankind may be cured of difeafes with the leaft poffible fatigue and pain; but from the experiments which I have made of moft of thefe proceffes, I muft beg leave to fufpend my affent to their general utility, or even to their frequent practicability.

Repeated trials upon dead fubjects will indoubtedly enable a man to pafs the robe, or perhaps now and then the feton, but he will alfo find it often abfolutely impracticable, and in the few inftances in which he may chance to fucceed as to this attempt, what will in general be the confequence? not what the writers on thefe fubjects have taught him to believe, a cure, but a fenfe of pain, and degree of inflammation, which the patient, before fuch attempts were made, was free from, an exaperation of the difeafe, and a lofs of much time, as I have more than once experienced. To which confideration may be added, that infants and young children are very often afflicted with this diforder, and that fuch proceffes as thefe, are abfolutely impracticable upon them.

I SHOULD

I SHOULD be very ſorry to be miſunder-
ſtood in what I now ſay, to have it ſuſpect-
ed, that I mean to derogate from the cha-
racter of thoſe gentlemen who have bee
the inventors of theſe operations, or, tha
I ſpeak ſlightingly of them, either becauſ
they are not my own, or becauſe I hav
not been able to ſucceed in the uſe o
them: it would give me great concern if
thought it would be believed that I acte
upon ſo mean, ſo narrow a principle; n
man is or would be more pleaſed wit
any real improvement in our art tha
myſelf, but having taken all the pains i
my power to apply the diſcoveries of whic
I am now ſpeaking to practice (the onl
teſt of good ſurgery) and having foun
them moſt frequently impracticable, al
ways ineffectual, I think myſelf oblige
to ſay ſo.

ANEL's ſyringe I have uſed ſucceſsfully
and think it may now and then be ver
well worth trying, in recent caſes mor
eſpecially, as it may always be uſed with-
out giving any pain, or running the riſqu
of raiſing an inflammation; but I muſ
alſo beg leave to obſerve, that if the bag i
not

ſkin and cellular membrane uninflamed, and the parts about ſoft and eaſy, if the patient will take care not to ſuffer too great an accumulation, will, by the frequent uſe of a vitriolic collyrium, keep the eye-lids clean and cool, and carefully avoid ſuch things as irritate the membrana narium, or occaſion a ſudden flux of lymph from the lachrymal gland, the diſeaſe may for many years, nay often for life, be kept from being very troubleſome, or inconvenient, without any ſurgery at all.—

SECT. V.

WHEN the diſeaſe is got beyond the ſimple ſtate juſt deſcribed, that is, when the parts round about are much, or conſtantly inflamed, or the ſkin covering the tumor is burſt, there is ſomething more to be done, if a cure is intended.

In this ſtate an opening in the upper part of the ſacculus lachrymalis becomes in general abſolutely neceſſary; and as a wound made by a knife leaves a much leſs diſagreeable ſcar than that which neceſſari-

being a mere ſimple diviſion, the other a loſs of ſubſtance; it will always be found beſt to anticipate the accident of burſting by making the opening, as ſoon as the integuments are in ſuch a ſtate as to threaten it.

For the making this inciſion authors have been very particular in their direction with regard to its place, manner, and form; they have ordered it to be ſemilunar, having its concave part toward the eye, and that the point of union of the lids ſhould be exactly oppoſite to the center of the inciſion; this lunated figure was calculated to correſpond with the courſe of the fibres of the orbicular muſcle, upon a ſuppoſition that a tranſverſe ſection of them, would produce an inverſion of the lower lid, an effect which never follows; all that the ſurgeon need obſerve, is to take care to keep the knife at a proper diſtance from the juncture of the palpebræ, to begin the inciſion a very little above a line drawn from that juncture toward the noſe, and to continue it downward; its form may full as well be ſtraghit as any other, and the beſt

inſtru-

ooked biſtory.

If the ſacculus is already burſt, the ace of opening is determined, and the ifice may be enlarged with a knife, or lated.

The inciſion made, the ſacculus ſhould moderately diſtended, either with dry t, or a bit of prepared ſponge; by hich means, an opportunity will be gain- in two or three days of knowing the te of the inſide of the ſac, and of the ictus naſalis; if the former is neither ughy nor otherwiſe diſeaſed, and the ſtruction in the latter but ſlight, it ſome- mes happens, that after a free diſcharge s been made for ſome days, and the in- mmation occaſioned by the firſt opera- on is gone off, that the ſac contracts itſelf, ſuperficial dreſſing, with moderate preſ- re, heals the ſore, the lachrymal fluid ſumes its wonted courſe, and the diſeaſe ſappears.

Of this I have ſeen more than one in- nce, and perhaps it would happen of- ner, if the very abſurd manner in which

ing the bag, did not prevent it; in this ſtat. ſucceſs is to be expected from the mo: gentle treatment only; whatever irritate: inflames, or deſtroys, will infallibly prever it.

If this ſimple method does not ſucceed or from the ſtate of the parts ſeems unlike ly to do ſo, another muſt be tried, whic the opening already made will enable u to put in practice: the point to be aime at is, if poſſible, to render the naſal duc pervious to the lachrymal fluid; and w muſt endeavour to obtain this end by ſuc means as give the leaſt pain, excite th leaſt inflammation, and leave the parts a near as poſſible in their natural ſtate, tha is, we are to endeavour to dilate the paſ- ſage from the ſac to the noſe, by ſome means which will gradually diſtend it with- out deſtroying its texture, in the ſame manner as the dilatation of the urethra ought to be effected in the caſe of ſtrictures, by paſſing either a probe, or a piece of cat-gut, or a bougie, gently into it, as far as it will eaſily go, and repeating it

occaſi-

occaſionally, until it is got quite through, and the paſſage is free *.

EVERY man will determine for himſelf, by what means he will endeavour to accompliſh this end, nor is it of very material conſequence which he prefers, provided it be done gradually, and without giving pain; a proper dilatation of the upper part of the ſacculus by dry lint, or a bit of prepared ſponge, will be found uſeful previous to the attempt toward paſſing any thing into, or thro' the duct; and it will alſo be neceſſary that the ſurgeon be poſſeſſed of a juſt idea of the ſize and direction of it, both in a natural, and a diſeaſed ſtate; for whoever has formed one only from viewing its bony channel in a dry ſkull, will upon experiment find himſelf much deceived with regard to its diameter in a living ſubject; the membrane which lines it is not extremely thin in a healthy ſtate, and when it is inflamed or thickened by obſtruction, the paſſage thro' the duct is thereby

* THIS caution is very neceſſary to be obſerved in the cure of ſtrictures of the urethra, in which caſe the proper intention is gradually to dilate the paſſage, and to procure an increaſed diſcharge of mucus from the lacunæ; this ſhould always be done gently, and by means which give as little pain as poſſible, whatever irritates or gives pain will certainly do miſchief, will add to the obſtruction, and increaſe the dyſury.

thereby rendered very small, if it is not quite ſhut up.

They of our anceſtors who miſtook this diſeaſe for an abſceſs, and found (as indeed they always muſt) extreme difficulty in filling it up with ſound fleſh, generally had recourſe to eſcarotic medicines for the deſtruction of that fungus which ſeemed to hinder them from accompliſhing their end; by which conduct they irritated all the neighbouring parts, increaſed the inflammation, and were moſt frequently fruſtrated in their expectation of a cure at laſt. The ſame kind of medicines were alſo uſed by thoſe who ſuppoſed the diſorder to be an encyſted tumor, with intention to eradicate the cyſt, which, they thought, prevented a cure by remaining behind; and both theſe methods of practice were vindicable, ſuppoſing their idea of the diſeaſe had been a true one, which it moſt undoubtedly was not; their reaſoning was right, but their principles were wrong; they were in general very little acquainted with the ſtructure and uſe of the parts, and totally miſtook the nature of the diſeaſe.

But

But now, that we are thoroughly acquainted with both, this kind of practice ought ſurely to ceaſe, as the preſervation of the ſacculus and duct, and not their deſtruction, are, or ought to be, intended: all cathæretic medicines muſt be wrong and prejudicial, at leaſt while the intention is ſuch; an intention at all times rational, and ſometimes capable of being fulfilled.

Notwithstanding the deſtruction of the bag is allowed to be wrong by moſt ſurgeons of the preſent time, yet there are many, who, by their manner of dreſſing it, after they have opened it, do really, tho' not intentionally, produce the ſame effect as our forefathers aimed at: it is ſtill a cuſtom with many, as ſoon as it is opened, to diſtend the cavity of it with a hard tent, or with doſſils of lint charged with eſcarotic medicines, ſuch as mercurius precipitatus ruber, &c. by which means the inflammation is increaſed, the ſkin and edges of the inciſion hardened, and the inſide of the ſacculus put under a neceſſity of caſting off a ſlough. This is one of ſeveral inſtances ſtill remaing of our adhering to old methods of practice, after the principles

many formed have been allowed even by ourſelves to be erroneous; for this manner of dreſſing the ſore is effectively the ſame as the antients made uſe of, while they ſuppoſed the diſeaſe to be an abſceſs of the caruncle, an encyſted tumor, or a callous ulcer with carious bone; and was by them intended very properly for the deſtruction of ſuch calloſity, to aſſiſt the exfoliation of the ſuppoſed caries, and to procure a firm baſis to incarn upon.

On the contrary, the point which ought firſt to be aimed at, immediately after having made an opening into the ſac, is to endeavour to remove the obſtruction of the natural paſſage from thence into the noſe, by the means already mentioned, which deſign this method of cramming in eſcharotic dreſſings muſt neceſſarily fruſtrate, muſt frequently render a ſimple caſe complex, and at leaſt retard that cure it is deſigned to expedite.

The only excuſe that can be now made for ſuch method of dreſſing, is that the ſurgeon is ſatisfied that the ductus ad nares cannot be reſtored to its uſe, and therefore

 by

as may fill up its cavity, and hinder the accumulation, or lodgment there in future.

If this was feafible, perhaps it might be a vindication of fuch treatment, but unfortunately it neither is, nor can be fo in general; and whoever will attentively examine the natural fituation and ftructure of the parts concerned, will immediately fee why it cannot. All, or the greateft part, of the difeafed and obftructed duct, lying in its bony channel out of the reach of what is applied to the infide of the facculus, muft prevent the generation of a firm bafis at its bottom, and produce a frefh collection of mucus, which in a fhort fpace of time lifts up the cicatrix, into a new tumor, and requires the fame treatment as if nothing at all had been done.

On the other hand, it muft not be denied, that now and then a cure has by this means been effected, but it has been fo rarely, that it can hardly be admitted as an authority or vindication of fo irrational an attempt.

them of very quick ſenſation, and eaſily irritated; and dreſſings are in fact extraneous bodies, and therefore when applied to ſuch parts cannot be too ſoft and light: ſuppuration is an act of nature, not of art, and is always beſt executed, when ſhe is leaſt diſturbed: this is a general truth, and will hold good in all parts of the body, even where ſuppuration may be moſt wanted; but in the preſent caſe, in which the lower part of the ſac, and all the duct, are often in ſuch ſtate as not to require any ſuppuration at all, eſcharotic dreſſings of any kind, by producing inflammation both of the eye and caruncle, by rendering the edges of the ſore hard, or ſloughy, and by deſtroying the communication between the puncta lachrymalia and ſacculus, muſt neceſſarily counteract the only proper intention of cure.

I WOULD not in this place be thought to mean that a mere ſuperficial pledgit is all the dreſſing that is required; no; a moderate dilatation of the upper part of the ſacculus is at firſt abſolutely neceſſary, in order to get eaſily at the duct below; but this

corrofive applications of any kind, and is beſt accompliſhed by prepared ſponge, which will diſtend to almoſt any degree, without deſtroying.

When a paſſage has been once obtained, t ſhould be carefully kept open, either by piece of cat-gut, a ſmall bougie, a leaden robe, or ſomething of that ſort; and when is thoroughly eſtabliſhed, the ſore may e permitted to contract, until it becomes o more than what ſerves for the introuction of the bougie into the duct; in his ſtate I would adviſe, that it be kept pen for ſome time, injecting now and then little aqua calcis, ſoftened with mell. ro-r. thro' from above into the noſe; and hen it appears, that the paſſage is ſo free, d ſo well eſtabliſhed, that there is good robability of its preſerving itſelf, the orice in the angle of the eye, by being cored only by a ſuperficial bit of plaſter, pledgit, will contract and cloſe; and if, ring its cloſing, moderate preſſure be ed on the ſacculus, to prevent a freſh acmulation of mucus, it will aſſiſt the re.

WHETHER the ſacculus in a healthy and undilated ſtate, is endued with any degree of contractile power, which it loſes by being diſtended, or to what other cauſe it may be owing, I know not; but have more than once been foiled in my attempts toward this method of curing the diſeaſe by a freſh collection of mucus, notwithſtanding the naſal duct has remained open, as appeared by the diſcharge made into the noſe, upon preſſure on the tumor, the immediate ſubſidence of the ſaid tumor, and the paſſage of an injection, or ſmall probe, after having again opened the ſac. Some of theſe have, upon being again healed, remained good cures, and others not; the uncertainty which attends theſe caſes is great, and the event never to be known but by experiment. Whoever ſays, that none of them are to be cured by the foregoing method, errs as much as he would, who ſhould expect it to ſucceed in all; where the diſeaſe is in ſuch ſtate, as to admit its being tried, it is very well worth while, as it is not painful, nor tedious; and where it does not anſwer our expectations, it is no hindrance to any other more efficacious one, being made uſe of afterward;

ſtances in the patient, or in the ſtate of the diſeaſed parts, muſt produce a variation in the neceſſary treatment, both in general, and particular; a bad habit will require the uſe of internal remedies; the combination of other diſeaſes of the neighbouring parts will add to the difficulty and trouble; and even the faireſt, and ſuch as ſeem moſt likely to ſucceed, do ſometimes reſiſt this, and indeed every other attempt.

FROM the neceſſity of keeping the eye bound while dreſſings are applied for the dilatation of the ſacculus, an inflammation is frequently raiſed; this added to the neceſſary diſcharge of ſerum, mucus, &c. is apt to heat and excoriate the parts about; therefore, warm fomentations, cooling collyria, epulotic cerates, and renewing the dreſſings as often as ſhall be neceſſary, with whatever elſe can contribute toward keeping the ſkin clean and cool, muſt be found ſerviceable, as well as pleaſant, and ſhould never be neglected.

SECT.

SECT. VI.

THE laſt ſtate which I mentioned of this diſorder, is that in which the natural paſſage from the ſacculus to the noſe is ſo diſeaſed as to be quite obliterated, or in which the bones are ſometimes found to be carious.

THE methods hitherto deſcribed have all been calculated to preſerve the natural paſſage, and to derive the lachrymal fluid again thro' it; in this attempt they are ſometimes ſucceſsful, but when they are not, there is no chirurgical means left, but to attempt the formation of an artificial one in its ſtead.

THE upper and hinder part of the ſacculus lachrymalis is firmly attached to the os unguis, a ſmall and very thin bone juſt within the orbit of the eye; which bone is ſo ſituated, that if it be by any means broke thro', or removed, the two cavities of the noſe, and of the orbit, communicate with each other, conſequently the os unguis forms the partition between the hinder part of the lachrymal bag, and the upper part of

making a breach in this partition that we attempt the formation of an artificial paſſage for the lachrymal fluid.

THIS operation, if conſidered merely as a perforation, is no invention of the moderns, the ancients undoubtedly performed it; but tho' it was executed much in the ſame manner, as it is now, yet it was not done with the ſame intention.

FROM the accounts which our anceſtors have left us of the diſeaſe in queſtion, it is plain, that they ſuppoſed it to be always attended with a degree of calloſity, and often with caries, and that the ſureſt way to obtain a cure was to lay the bone bare; this they effected, either by cauſtic or cautery, according to the humour of the ſurgeon, or the fears of the patient; if cauſtic applications were uſed, they waited the ſeparation of the eſchar; and if they found, or believed the bone to be altered, they applied an actual cautery to it; if the bone on which the iron was applied was the os nguis, it was too thin to bear much heat, much preſſure, conſequently was eaſily burnt, or broke thro', and by that means an

opening

was also sometimes made use of instead of cautery, and the same effect produced thereby *.

By each of these methods, a passage being made from the sacculus lachrymalis into the nose, a cure was sometimes accidentally obtained; but the cautery was applied, either to destroy the supposed callosity, or to desquamate a caries; and the terebra, either for the same reason, or to make a passage for the discharge of matter, which lodged, and as they thought, hindered the healing of the sore; for as they were not acquainted with the natural passage of the lachrymal fluid, it would be absurd to suppose,

* Oculo et cæteris junctis partibus bene obtectis os ferramento adurendum est vehementius, quod si jam carie vexatum est, quo crassior huic squama abscedat quidam adurentia imponunt. Celsus.

Cum isto pulvere in veritate fere mortificabam omnes fistulas curabiles, et cum cauterio ferreo, aut æneo—— factâ mortificatione tali totius carnis usque ad os, cum pulvere aut unguento superdictis superpone, mortificato butyrum et escharâ aspice et si fuerit os corruptum cauteriza ipsum usque ad ejus profundum. Gul. de Saliceto.

Postea si homo fuerit delicatus, per istud foramen mittatur Canellus ferreus vel æneus subtilis usque ad profundum si poteris, et per ipsum canellum ferrum candens immitte et fistulæ radices decoque: at si timuerit ignem immittatur pillula de unguento ruptorio. Rolandus.

Osse detecto ferrum imprime calidum supra ipsum et ipsum cauterium mediocriter comprimendo postea imple totum vulnus cum oleo rosarum misto cum vitello ovi.

 Lanfranc.

they intended the formation of an artificial one. Callosity and caries were their two characteristics of the disease; the dissolution of one, and the exfoliation of the other, were all they had in view from the use of either caustic or cautery, and the perforation of the os unguis was either accidental, or made merely for the discharge of matter *.

I INDEED,

* FABRICIUS AB AQUAPENDENTE who in general copies Paulus, speaks of the perforation as meant only to make a depending orifice for matter, "post carunculæ et loci excisionem, terebra humorem aut pus in nares derivarint." FAB. AB AQUAPENDENTE.

GUL. DE SALICETO, and indeed many other of the antient writers, speak of using both cautery and terebra to the purpose of deriving the matter and sanies which lodge in the eye, into the nose; and, by making a depending orifice, to procure a firm basis to heal on. "Aspice os, et si fuerit corruptum cauteriza ipsum usque ad ejus profundum, et concavitatem cum cauterio punctuali, et perfora ipsum ad aliam partem, ejus ut sanies per nasum fluat, deinde incarnetur et consolidetur." GUL. DE SALICETO.

Indeed the formation of an artificial passage for the lachrymal fluid could make no part of the intention of those, who were not rightly acquainted with the natural one.

PAULUS mentions perforation with the terebra as the practice of some in his time, but from what he says, it is plain he did not practice it himself, or think it necessary; and that he regarded it only as a method of making a depending orifice; his words are, "Quod si jam carie vexatum est ferro candenti, acuto, ac in cuspidem abeunte adurimus spongiâ frigidâ madente oculo imposita.

'SUNT qui post carunculæ excisionem terebra usi humorem aut pus in nares derivarint; nos autem satis habuimus eousque solum ferramentis ad Ægylopem accomodatis adurere ut squama abscederet."

PAULUS AGINETA.

SEE also FAB. AB AQUAPENDENTE.

the old writers have left us on this ſubject it will appear, that tho' they knew that a paſſage into the noſe was ſometimes a conſequence of their uſe of the terebra and cautery, yet the operators had no very accurate knowledge of the parts they made ſo free with; no preciſe idea of the bone on which their inſtruments were applied, or thro' which they paſſed; nor of the place moſt immediately proper, for ſuch application of them; ſometimes they perforated the os unguis very properly ſometimes the cautery or terebra was thruſt into the bony channel of the natural naſal duct, and ſometimes they were applied to the naſal proceſs of the maxilla ſuperior: the direction given by moſt of them to raſp the bone (ſcalpris abradere) and to impreſs the cautery with ſome force, that the bone may be ſooner exfoliated, (ut citius ſquama abſcedat) plainly prove that either they were not aware of the tender ſtructure of the os unguis, or that they did not intend to apply their inſtruments to it; if the former was the caſe, the perforation was accidental; if the latter, they muſt have often done much more harm than

good;

deſtroyed unnecessarily parts which have little or nothing to do with the diſeaſe; and by ſuch treatment of them muſt have much oftener prevented, than accompliſhed a cure *.

The intention of the preſent practitioners in making this perforation is different from that of their anceſtors; but it is more rational, and founded upon the nature and uſe of the parts concerned in the diſeaſe; it is to form and maintain a new artificial paſſage from the lachrymal bag into the noſe, when the natural one can no more be rendred uſeful, and without any view to any thing elſe; this, I ſay, is the aim of them all; but tho' they are perfectly agreed in their intention, yet they are not ſo with regard to the inſtrument which they uſe, ſome ſtill continuing the actual cautery,

* Petrus de Marchetti, tho' perfectly ſenſible that the os unguis was often broke thro' by the cautery, yet inſiſts upon it, that it ſerved no other purpoſe than to haſten exfoliation, "Præterquam quod hujus perforationis non "alius ſit uſus quam ut os perforatum aut inuſtum citius "abſcedat. Obſervandum tamen non eſſe perforandum os "niſi præſente maxima ipſius corruptione, ſola ſiquidem "ejus ſuperficie corrupta aut alterata ſat fuerit partem læ-"ſam abradere. Petr. de Marchetti.

And Mr. Verdue, a very modern writer, is alſo of the ſame opinion, "Le meilleur remede pour amorter l'acide "qui cauſe la carie, c'eſt de paſſer legerement un cautère "actuel ſur l'os ſans le percer."

THE ancients preferred the cautery, for reaſons which have already been aſſigned; but ſince the ſymptoms of calloſity and caries have been found to be very infrequent, and the os unguis has been perforated ſolely with a view to make an artificial paſſage into the noſe, the cautery has with many loſt much of its ancient credit, and other inſtruments have been ſubſtituted in its place, which give leſs pain at the time of uſing, and leave leſs deformity afterward.

BUT tho' many have laid aſide the hot iron, yet it ſtill has its advocates, who prefer it to every other inſtrument, and who have therefore endeavoured to obviate its inconveniences; they have directed that the cannula thro' which it paſſes, be made of a conical form, and ſo large at its lower end, as that they ſhall not touch each other; they have ordered this cannula to be wrapped round with wet rag, at the time of uſing it; they have placed a check upon the top of the iron to prevent its point from going too far, and have been

particular

ſoon as it is got thro'.

But notwithſtanding theſe and every other caution, the cautery gives great pain at the time of uſing, lengthens the attendance, and moſt commonly produces unneſſary deformity, even in the hands of the moſt dextrous, not to mention the horrour occaſioned by thruſting a hot iron into the corner of the eye.

When the inconveniences ariſing from the uſe of this inſtrument, even in the beſt hands, are important, it may be eaſily gueſſed what they muſt be in thoſe of the clumſy and ignorant; and therefore unleſs ſome real advantage attends it, it ought certainly to be ſo diſcouraged, that no one may attempt to revive it; let us then ſee with what intent it has been uſed by thoſe who have appeared moſt fond of it, and who may fairly be ſuppoſed to have beſt known how to manage it.

The defence made by the wet rag againſt the heat of the iron, the diſproportioned ſize, and the figure of the cannula, very plainly ſhew, that its effect is deſign-

 ed

the check at the upper as clearly ſhews, that that point is deſigned to paſs no farther than juſt thro' the bone, while all the ill effects are occaſioned by the upper part of the cautery on the eye-lids and angle of the eye; now, if it is not deſigned to produce any effect on any of the parts thro' which it paſſes down to the bone, but merely to burn thro' that and the membrana narium, and thereby make an opening into the noſe, I do not ſee how it differs from any other perforator of equal ſize, except in the miſchief it does to the parts above, to which it ſhould do nothing.

It does indeed burn the bone and membrane, thro' which it pierces, and thereby prevents the orifice from cloſing again immediately, and this is certainly the principal end of perforation, by whatever inſtrument it is performed; but it is alſo as certain, that the ſame end is obtainable by means leſs miſchievous and leſs horrible.

Our anceſtors had a very plauſible reaſon for uſing it, their ideas of calloſity and caries always accompanied this diſeaſe, and authoriſed them to make uſe of ſuch applications

theſe are ſymptoms which very rarely occur, or even if they do, that they are removable in a much eaſier manner, we are no longer vindicated in continuing an alarming and a painful proceſs, when we can obtain the ſame end by much gentler means; for whether the membrana narium be burnt thro', or divided in any other manner, it is the future method of dreſſing that opening that muſt maintain it, let it be made by whatever inſtrument, or in whatever manner it may.

The late Mr. Cheſſelden was a warm patron of the cautery, took a good deal of pains to prevent it from doing miſchief, and has ſaid in its defence, that—" other me-
" thods of curing this diſeaſe have been
" much recommended, though often un-
" ſucceſsful, but this well performed is in-
" fallible." After ſo poſitive an aſſertion, I am ſorry to be obliged to ſay, that it is contradicted by manifold experience, that there have been many inſtances of perfect cures performed without the uſe of a cautery; and that ſome of thoſe who have been cauterized by Mr. Cheſſelden himſelf have

been

took, prevent the effect of the heat of the iron, or leave his patient without a weeping eye.

The intention is merely to make an opening thro' the os unguis and membrana narium into the cavity of the nose, and to treat that perforation in such a manner as that it shall most probably remain open, and give passage to the lachrymal fluid from the puncta, after the external sore is healed.

The extreme thinness of the bone renders the passage of the instrument very easy, and if the breach which is made, be of any tolerable size, I am inclined to think that it never is filled up again by bone, but that when it is closed, it is by the membrane; and therefore it is the surgeon's business to make a pretty large opening in the bone, and to prevent its being closed again, by rendering the edges of the membrane on each side of it callous.

To make this opening, many different instruments have been devised, and used, a large

each of which, if dextrouſly and properly applied, will do the buſineſs very well; the one neceſſary caution is, ſo to apply whatever inſtrument is uſed, that it may pierce thro' that part of the bone which lies immediately behind the ſacculus lachrymalis, and not to puſh it too far into the noſe for fear of injuring the os ſpongioſum behind, while it breaks its way.

For my own part I have always uſed the curved trochar, which has ſerved my purpoſe well, and from which I have never experienced any inconvenience; in uſing it, the point ſhould be turned obliquely downward, from the angle of the eye toward the inſide of the noſe; the accompliſhment of the breach will be known by the diſcharge of blood from the noſtril, and of air from the wound upon blowing the noſe. The moſt preciſe direction in this part of the operation will be of but little uſe to him who has no idea of the natural ſtructure and diſpoſition of the parts concerned, and who ought therefore to get ſuch information as ſoon as he can; but whoever is at all acquainted with this matter, or will

ridge, that the lachrymal ſac is connected to all that part which is anterior to this ridge, and that the poſterior part of the bone contributes to form the orbit of the eye, and has little or no connexion with the lachrymal ſac; the trocar muſt be applied therefore to that part of the bone which is anterior to the ridge, and conſequently behind the lachrymal bag; by the paſſage of the inſtrument, all this part of the bone will in all probability be broken, but from which no miſchief will enſue.

An attention to the natural ſituation of theſe parts will alſo ſhow the practitioner, that if the point of his inſtrument be paſſed in a tranſverſe direction with regard to the noſe, the os ſpongioſum ſuperius will be unneceſſarily wounded or broken, and if it goes in too perpendicular a direction, it may get into the channel of the natural duct, and its point will be ſtopped by bearing againſt that part of the maxilla ſuperior which contributes to the formation of that channel.

It

it may break the os unguis to ſome diſtance from the place where its immediate point is fixed; to which I can only anſwer, that I have performed the operation a great number of times, and never yet have ſeen any inconvenience to ariſe from it; indeed a total removal of a ſmall piece of the bone would be a thing rather to be wiſhed for than avoided; if we may reaſon by analogy, it ſeems to be a neceſſary requiſite toward preſerving a future paſſage, for we very well know in a caries of the bones forming the roof of the mouth that they are ſometimes bare for a large compaſs, and by caſting off leave a conſiderable aperture into the noſe, yet in many caſes, when the virus is removed, and the habit recruited, that opening will ſo contract as not to ſuffer a ſmall quill to paſs where you might have introduced your finger, nay often will quite cloſe, and therefore tho' the opening made in the os unguis may poſſibly in ſpite of all endeavours be again cloſed up, yet a free breach in it ſeems to be the moſt likely means to prevent it, and upon this principle I have always turned the perforator round very freely whenever I have uſed it, have never ſeen any miſchief from it,

with it, in ſome meaſure to this method of uſing it.

As ſoon as the perforation is made, a tent of lint ſhould be introduced, of ſuch ſize as to fill the aperture, and ſo long as to paſs thro' it into the cavity of the noſe; this ſhould be permitted to remain in 2, 3, or 4 days, till the ſuppuration of the parts renders its extraction eaſy, and after that a freſh one ſhould be paſſed every day, until the clean granulating appearance of the ſore makes it probable that the edges of the divided membrane are in the ſame ſtate; the buſineſs now is to prevent the incarnation from cloſing the orifice, for which purpoſe the end of the tent may be moiſtened with ſpir. vitriol. ten. or a piece of lunar cauſtic ſo included in a quill, as to leave little more than the extremity naked, may at each dreſſing, or every other, or every third day be introduced, by which the granulation will be repreſſed, and the opening maintained, and when this has been done for ſome little time, a piece of bougie of proper ſize, or a leaden cannula may be introduced inſtead of the tent, and leaving off all other dreſſing, the ſore may be ſuf-

fered,

will permit, which ſhould be of ſuch length that one extremity of it may lie level with the ſkin in the corner of the eye, and the other be within the noſe.

THE longer time the patient can be prevailed upon to wear the bougie, the more likely will be the continuance of the opening, and when it is withdrawn the external orifice ſhould be covered only by a ſuperficial pledgit, or plaiſter, and ſuffered to heal under moderate preſſure.

THERE is another method which has been much recommended by ſome French writers to prevent the cloſing of the opening in the os unguis, which is to introduce a cannula either of gold or ſilver, or lead into the aperture; and to permit the ſore to heal over it, ſuffering the cannula to remain, or to come away by the noſe.

FOR my own part I cannot ſay any thing to it, having never had occaſion to try it, the caſes of this kind which I have had under my direction, having generally ſucceeded under ſome of the methods already mentioned, which methods will

geon is clear in his intention, purſues it ſteadily, and properly, and refrains from doing too much, tho' I muſt again repeat what I have ſaid before, viz. that there is no method of treating this diſorder which is infallible, none that will abſolutely and in all caſes prevent a return, eſpecially in ſcrophulous habits: yet when a juſt diſtinction is made between thoſe caſes which are in their own nature incapable of cure, and thoſe which by being improperly treated are not cured, I am inclined to believe that the number of the former, will be found much ſmaller than it is generally imagined to be.

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Qui dat Videre, dat Vivere.

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1650240

TO

Sir *Jeremy Sambrooke*, Bart.

SIR,

EVER ſince I firſt had the Honour of being conſulted, and employed, in a Caſe, on which your Welfare and Happineſs ſo immediately depended; as the good Opinion you expreſſed of my Judgment, and the great Confidence you have all along repoſed in my Integrity, gave me the utmoſt Delight and Satisfaction; ſo they failed not to excite my beſt Endeavours, and encouraged me to try, by the ſtricteſt Application, extraordinary Pains, and unwearied Dili-

to be an Inſtrument of Good to a Gentleman of your Conſequence and Merit, in a Matter of no leſs Importance, than the Reſtoration of that unvaluable Bleſſing of Sight.

Incited by the Hopes of obtaining ſo deſireable an End, I enter'd on the Work with Pleaſure, and proceeded in it with Aſſiduity and Circumſpection. Nothing was left untried, that Reaſon could dictate, or Art direct, in this ſo nice, and important an Affair. And Heaven had ſo far bleſſed my Undertakings, and ſucceeded my Endeavours, that I had happily ſurmounted the moſt material Difficulties, ſo that the Good I purſued was now in View; and I had, not without Reaſon, entertain-

ed

I had ſo ſucceſsfully brought to this happy State, I ſhould ſhortly ſee accompliſhed with equal Felicity; namely, that You might reap the Benefit, and myſelf the Pleaſure of having all my Labours crowned with a proſperous and good Event.

Judge then, Sir, if I muſt not be very ſenſibly touched at the Diſappointment of all my well-grounded Expectations; a Diſappointment that affects me with leſs Sorrow on my own Account than Yours. For though I cannot but regret the Loſs of that Pleaſure and Reputation, I had ſo nearly acquired; yet, as I am conſcious of having taken ſuch Meaſures, as all impartial Judges muſt approve, and would, I am perſuaded, if continued,

fired Effects; I am but lightly concerned, with respect to myself, and nothing gives so much Pain, as that I am hindred from compleating the Happiness of a Gentleman, whose Worth and Goodness make him so deservedly Esteemed, and to be conducive to whose Welfare, was the Summit of my Wishes, and the utmost Height of all my Ambition.

That my Hopes of Success were not without Foundation, I presume to have fully made appear in the following Sheets, to every Man of Understanding and Probity. I have sufficiently justified all my Proceedings to the *Skillful*, who, as they cannot but see, how nearly the Cure was effected, and how easy it is still to

compleat

compleat it, muſt therefore be ſenſible of the great Injury you would ſuffer to have it obſtructed, or ſo much as retarded. And thoſe amongſt them, who have the Happineſs of knowing You, muſt undoubtedly conceive juſt Indignation againſt any, who ſhall be ſo cruel and wicked, as to deter You from the Enjoyment of that Bleſſing, which Providence has in a Manner put into your own Hands, and ſeems as it were, to Court your Reception: And of which, you cannot be now deprived, without the greateſt Injuſtice, and baſeſt Inhumanity.

That you may ſtill live to enjoy the Bleſſing of Sight, and every other Advantage, that can contribute to make your Life Happy, and ren-

der

der the Continuation of it as pleasant to your self, as it is serviceable to great Numbers of Others; is the sincere Desire, and fervent Prayer, of,

SIR,

Your most obliged,

Humble Servant,

Great Queen-Street,
Lincoln's-Inn-Fields,
October 1, 1743.

JOHN TAYLOR.

THE

THE CASE OF Sir *Jeremy Sambrooke*, Bart.

Fairly and Impartially Stated, &c.

AS the Caſe of Sir *Jeremy Sambrooke*, has been the Subject of much Converſation, as well from the Singularity of the Diſorder, and the great Variety of extraordinary Circumſtances attending the Cure, as from the raiſed Expectation of a great Number of Perſons of Worth and Diſtinction, peculiarly intereſted in the good, or ill Succeſs, attending a Gentleman of ſuch univerſal Eſtimation, and exten-

ſive

ſive Merit; whoſe many amiable Qualities render him ſo deſervedly Dear to all who have the Honour of his Acquaintance, and who, conſequently cannot but be very ſenſibly affected, with Pleaſure or Uneaſineſs, proportionable to the happy or unhappy Event of an Undertaking, in which his Welfare is ſo immediately concerned: I was induced to think, that a full and particular Narrative of my whole Proceeding, in the Treatment of this Gentleman's Indiſpoſition, would not be unpleaſing to the Public; eſpecially, as it is given by his own Permiſſion, and publiſhed with no other View, than that of juſtifying all the Meaſures I have taken, and demonſtrating, that a further Purſuit of them can hardly fail, of being attended with a happy Recovery of uſeful Viſion.

About the begining of *June* laſt (in Conſequence of the good Succeſs, I was ſo happy as to obtain in a parrallel Caſe, with the Lady his Siſter, and ſeveral Others *, whoſe Recovery had been enquired into, and known by ſome of that Honourable Family) I was conſulted concerning a Diſorder in the left Eye, under which this Gentleman

* Mrs. *Hooper, of Tunbridge.* Mr. *Croſby, of Briſtol.* Mr. *Hammond, of Hatton-Garden,* &c.

Upon Examination, I found the Cryſtalline totally Opaque, with all the Appearances of that Solidity in the Opacity; which conſtitutes, what is vulgarly term'd, *The Maturity, or Ripeneſs of the Cataract*, not without the ſtrongeſt Proofs, that can be, of the healthful Senſibility of the Immediate Organ of Sight, namely, the Mobility of the Pupil, and the Senſation of Light.

Encourag'd by theſe ſtrong, preſumptive Arguments of Succeſs, I concluded (which I believe every one will allow to be a reaſonable Inference) That upon Depreſſing the Opaque Cryſtalline, and thereby recovering the Tranſparency of the Axis of the Globe, ſuch uſeful Sight, as is uſual in the like Caſes, would undoubtedly be reſtored.

Upon Enquiry made into the Patient's general Temperament, the chief Thing worthy of Obſervation, was, that he had for a Number of Years been afflicted with a Chronical Pain in the back Part of his Head. This one Objection would certainly have over-ballanced all other Encouragements, and have deterred me, from attempting

 the

of Sight, from theſe unexceptionable Arguments already mentioned, which I have never experienced once to fail, amongſt that great Number of Subjects, and variety of Circumſtances, which I have had the Opportunity of treating in Caſes of the ſame Nature.

Notwithstanding all theſe good Appearances in the Gentleman's Favour, the Cryſtalline being depreſſed after proper Preparations, with great Facility, and all imaginable Succeſs, in the Operation; to my extraordinary Surpriſe, I found, that on reſtoring the Axis of the Eye to its natural Pellucidity, he did not experience the Senſation of any additional Light, as might reaſonably have been expected, from what had attended the Lady above-mentioned, and Numbers of Others in the like Circumſtances.

Early in the following Morning, I found ſome Symptoms, which indicated a Return of the wonted Head-ach, and upon examining the Globe, I perceived the Axis to be tranſparent, and yet the Eye inſenſible of the Impreſſion of the Object: I was now convinc'd, that this want of Sight, was owing to a Defect in the Brain, obſtruct-

fore resolved to cut the Artery; judging this threatn'd return of his usual Pain, to be at least attended with an extraordinary Distention of the Blood-Vessels in the Brain: This prognostic proved just; for upon Dividing the Temporal Artery, the Patient was immediately freed from the Symptoms of his wonted Pain, and in a few Days after, his Eye had a Sensibility, (though confused) of the Impression of the Object.

It is very remarkable, that the Seperating the Artery, (though attended with so happy an Event,) was notwithstanding the only Source of all those succeeding Interruptions, in the Progress of the Cure; and the sole Reason, why this Gentleman, yet stands in need of a little more of my Assistance for a perfect Recovery of useful Sight; and all this from the indispensable Necessity, we lay under, of not admitting the Application of a general Bandage; least the Return of the Head Ake, might unhappily deprive us of that Degree of Vision, which we had already obtained, and which there appeared such high probability of Improving to a great Perfection.

The

of itself at the Wound; which put me under the neceſſity of contriving ſuch a Bandage, as might make a more immediate Compreſſion, on the Part, without affecting the whole Head, (not being willing to apply the Bandage uſual in ſuch Caſes; for the Reaſons abovementioned;) this was not followed with its deſired Effect; for the next Day the Artery bled afreſh: In ſhort, being ſtill unwilling to venture the uſual Bandage, ſeveral Bandages were contrived, and ſucceſſively applied, all tending to the ſame End, namely to compreſs the Part, without, affecting the whole Head; but Maugre all our Endeavours, for upwards of twenty Days; (during which the Patient underwent a great Number of Bleedings at the Wound;) nothing was Effectual, 'till at length we were reduc'd to the ſad Dilemma of expoſing the Gentleman to the loſs, either of Sight, or Life: In this Caſe, there was no room for Deliberation; I was neceſſiated to apply the uſual Bandage, which had, as far as regarded the wounded Artery, all deſirable Succeſs, but with reſpect to the Eye, was attended with Conſequences of a very different Nature; the particulars of which I am now to relate.

Not

Not long after the Application of this Bandage, the ſo much dreaded ill Effects appear'd; the Patient's Head began to be afflicted with its uſual Pain, and his Eye attended with all the Symptoms, that indicate an approaching Inflamation. On Inſpecting the Eye, the ſecond Day after the Application of the Bandage, I found a ſmall Quantity of Matter collected in the lower Part of the Cornea, between its Interior Pellicles, not much unlike that, to which (from the Reſemblance it bears to the White of the Root of a Human Nail) has been given the Name of Onyx. This was a very formidable Symptom, for it Incited, an extraordinary Pain, not only in the Nerves of the Immediate Organ of Sight, by the Preternatural Plethora of the Globe, but alſo in thoſe Parts of the Brain, from whence theſe Nerves take their Origin. In this Situation, I well knew, that no Ceſſation of Pain could be expected, till either the Cauſe was remov'd by Diſcharging this Extraneous Matter from between the Pellicles of the Cornea, or till the Nerves of the Immediate Organ of Sight, had loſt their Senſibility by the continuance of the Preſſure: But this Operation, I durſt not then Attempt, by Reaſon of the attending Inflammation,

mation, the Cause of which I was compelled to permit, least by removing the Bandage, the Bleeding of the Artery should be repeated; and had I performed it, during the Continuation of the Bandage, and consequently of the Inflamation, it would be of no Use, as its return, after a short Time, would have been unavoidable. I therefore chose, rather than to permit a total Loss of Sensation in the Nerves of the Immediate Organ of Sight (an Effect which would infallibly have happened, had the Pressure continued long in the same Degree) to have Recourse to general Evacuations, in order to hinder, as much as possible, the extraordinary Supplies to the Arteries, in and about the Globe, consequent on the Pain incited by the Pressure: These Evacuations had their good Effect; for though it could not be supposed that by them, any Part of the Matter could be discharged; yet, as this Method mitigated the Inflamation, the Augmentation of the Matter was intirely prevented.

In a few Days after, I found this Matter, (though not at all encreased in Quantity) had forced its Way, (a Thing not unusual) into the Anterior Chamber of the Aqueous, consequently was no longer the Onyx, but new constituted, that

Disease

ently ſhewn in a Lecture on this Subject. This Tranſition of the Matter, gave increaſe to the Pain; not from any Augmentation in its Quantity, but from the Change of its Situation; it being now lodged, immediately upon the Iris, and indicating a Neceſſity, for either a quick Diſcharge by Operation, or the Repetition of our wonted Evacuations; I chooſed the latter, being apprehenſive, that the Matter might have acquired ſuch an Acrimony, as would corrode the Sides of the Aperture in the Cornea, and leave it irrecoverably open; the undoubted Effects of which, muſt have been a continual Efflux of the Aqueous Humour; Inſtances of which I have frequently met with. Nor indeed was this a needleſs Precaution; for after I had alleviated the Inflammation by proper Methods, I then perceiv'd, the Matter was not Acrimonious, by the Facility with which the Wound was healed immediately after its Diſcharge.

I did not venture to make an Opening large enough to diſcharge the Matter at one Puncture; chiefly, that I might avoid the Danger of wounding the Iris on the ſudden following of the Aqueous Humour, and the immediate Change of the

Necessity of this Precaution, I was well acquainted with, from my having ſo often obſerv'd, That all thoſe direful Conſequences, which ſo frequently ſucceed the common Method of Opperation, owe their Origin to this important Accident : I therefore made ſeveral Punctures, for its Diſcharge, to the Number of near twenty at different Times, till I was ſo happy as to entirely clear the Aqueous Chamber of this extraneous Matter, when in its ſtead, there remained (as is uſual enough) a few Particles of Blood, proceeding probably from the Section of ſome few of thoſe Blood Veſſels, which empty themſelves in that Part of the Aqueous Chamber, and from whoſe Extremities, the Blood, from which the Matter was collected, was at firſt ſeperated ; this was Diſcharged in the ſame Manner, and with equal Succeſs, as the precedent Matter ; till I had at length left the Aqueous Chamber entirely free from any extraneous Matter whatſoever.

During all this Time, 'till the Matter was Diſcharged, I was under the Neceſſity of continuing the Regimen hitherto obſerved, to ſecure the Immediate Organ of Sight, from the Loſs of Senſibility, which muſt have been the

inevitable

neceſſary Precautions.

HERE I cannot help remarking, that there is ſomething very peculiar and extraordinary in this Caſe, and what perhaps has hitherto been unprecedented; that an Inflammation ſhould be excited by a Cauſe, the Permiſſion of whoſe Subſiſtence was unavoidable; and yet, ſuch were the Methods taken, that the Nerves of the Immediate Organ of Sight, did all along from the firſt Section of the Artery, and do at this preſent Time, ſtill maintain their healthful Senſibility, which without theſe Methods, could never have been effected.

THERE is yet another remarkable Circumſtance, which muſt not be omitted; that during the Continuance of the Inflammation, occaſioned by the extraneous Matter (which for the Reaſons already given, could not be ſooner Diſcharged) the Pupil gradually loſt its Mobility and Figure, 'till at laſt it remained nearly cloſed.

I need not here obſerve, that there are four general Things eſſential to the Reſtoration of Sight:

lucidity of the Axis; to enable the Medium within the Axis, properly to tranſmit the Light; and To maintain the Figure and Mobility of the Pupil.

THAT we have in this Gentleman's Caſe, obtained the three Firſt (which are by far the moſt Difficult) is indiſputable; ſince, during the Continuance of the Extraneous Matter in the Eye, 'till after its Diſcharge the Pupil became too contracted to admit ſufficient Light; he was able to diſtinguiſh the Figure of the Object, which he could never have done, had not the Axis of the Eye been perfectly pellucid, for the Admiſſion of the Light reflected from every Point of the Object, and its Medium, in a ſtate proper to Tranſmit it, and had not the Nerves of the Immediate Organ of Sight, at the ſame Time maintained their healthful Senſibility; there is therefore, nothing further required for recovery of that Sight, which is uſual after the Depreſſion of the Cataract, (which with the Aſſiſtance of Glaſſes, we all know, is obtained to a great Perfection) than the bare Opening the contracted Pupil, and thereby obtaining a free Paſſage for the Light.

HERE

Case, which must not be passed over in Silence; and that is, that the Pupil is not only Contracted, but also the whole Iris is almost equally Elevated towards the Cornea; which happened the 2d Day after the total Discharge of all the extraneous Matter from the Aqueous Chambers, a Symptom not unusual in a long continued Inflammation; but this was not a Circumstance of Consequence sufficient to make us reject the Operation, because it will by no means render the Success less certain; for whether there be, or be not, any Aqueous Humour behind the Iris, the Opening the Pupil, in the Manner I am well known to Practice, must infallibly be followed with the Recovery of useful Sight; the Reasons are, that if on the one Hand, there is Aqueous Humour behind the Iris, as I have good Reason to believe there is, I then (by an Operation, I frequently Practice, with great Facility and no Danger) Reinstate the Iris so far, at least in its healthful Position, that it shall be no Impediment to the Restoration of useful Vision; and if on the contrary, there be no Aqueous Humour behind the Iris, then it

is

preſt, (as is plain from that Sight, the Eye always maintained) and the extraordinary Elongation and Convexity of the Vitreous, will compenſate for the Loſs of the Aqueous: and he muſt be but a very ſuperficial Judge in Optics, who does not know, that this Loſs of the Aqueous, in ſuch a State of the Eye, can no way impede a ſufficient Refraction of Light properly Tranſmitted.

I am not ignorant, that it has been thought a diſputable Point, whether or no the Globe has not loſt ſomething of its healthful Figure; but that it has not, ſeems very Evident, ſince it is not eaſy to conceive, how any Disfiguration of the Globe could happen without ſuch Preſſure on the Nerves of the Immediate Organ of Sight, as muſt inevitably have deprived them of their healthful Senſibility, which I have already ſhewn, is not here the Caſe: But even giving this large Conceſſion, in order to remove every poſſible Objection, and admitting, the Globe has ſuffered ſome Alteration of Figure, yet even this is no Argument againſt the Probability of Succeſs in the Operation, ſince

we

of the Immediate Organ of Sight do retain their healthful Senſibility, and there are ſeveral Diſeaſes of the Eyes in which the Globe loſes its Figure, without any Defect of Sight.

I am ſorry, that I am obliged, in this Particular, to diſſent from the Gentlemen with whom I had the Honour to be jointly Conſulted; and whoſe extenſive Knowledge and uncommon Abilities no One holds in higher Eſtimation than myſelf. But as I am more peculiarly intereſted in the preſent Caſe, and my Reputation more immediately concerned in the good or ill Succeſs that ſhall attend any Meaſures concerted for its Treatment, and as my whole Life has been ſpent in Studies of this Nature, and my Experience for a great Number of Years, been confined to this particular Practice, thoſe Gentlemen will Pardon me, if I appear even a little warm on this important Point; ſince the Arguments I have offered to prove, the Globe has not ſuffered any Disfiguration (and even on admitting it, that the Objection can be of no great validity) appear to me very cogent and powerful. And I am ſo far from urging them out of any Love to Diſſention, or Diſputation, that 'tis with the utmoſt Re-

luctance

to the Assertions of those Gentlemen, whose good Opinion I so greatly Prize; and whose Judgment I so highly Honour, that nothing would afford me greater Delight and Satisfaction, than to have my Sentiments concur with Their's, and any Measures I shall take, so happy as to meet with their Approbation.

HAVING thus far proved the reasonableness of expecting the perfect Recovery of this Gentleman's Sight, it remains for me to explain, how this good Effect may be attained without any ill Consequence, even that of a simple Inflammation. And this will evidently appear to any impartial Judge, if it be remembered, that there is nothing required here besides the Opening the Pupil, which is now contracted by a Multitude of little Cicatrices, all insensible, as Experience Daily shows: And as this Aperture through the Globe, is not made in or about, but much below the Horizental Line, where none of the Nerves designed for the Service of the Iris, and Uvea pass, and when we are in the Globe, we pass only through the Vitreous Humour, the Ligamentum Ciliare being, in this State of the Eye, far enough out of Danger of being wounded,

'tis

'tis impoſſible any ill Conſequence ſhould attend the Operation, ſince there is no ſenſible Part wounded; all this is plain, not only from Daily Examples in this Operation, but alſo from the well known Experiment of peircing the Eyes of Animals without the leaſt ſucceeding Inflammation.

Having thus explained the Method, and therein proved the great Probability (I had almoſt ſaid certainty) of this Operation being attended with all deſirable Succeſs, without expoſing the Patient to the Danger of the leaſt ill Conſequence, I appeal to every thinking Man how unjuſt, nay, how Inhumane it muſt be, to endeavour to deter this Gentleman from embracing the happy Opportunity, and purſuing but a little longer thoſe means which may with ſo much Eaſe, and ſo little Danger, reſtore to him the Fruition of that ineſtimable Bleſſing of Sight, of which he has been ſo long deprived, and without which, all other Privileges and Poſſeſſions are taſteleſs, and Life itſelf ſcarce worth the keeping!

It may, therefore, be reaſonably expected, that all, who are ſo happy as to be any way peculiarly intereſted in this Gentleman's Wel-

fare,

laudable Design, or retarding its Execution, that on the contrary, they will rather use the utmost of their Endeavours to persuade him to pursue that Happiness a step farther, which stands, as it were, expecting his Reception; as there now remains no Manner of Difficulty to remove that slight Obstruction, that lies between him and the Enjoyment of that Blessing, of the Loss of which, none can be truely sensible, but they who are so unhappy as to have been deprived of it; and I think I may reasonably affirm, that every Argument calculated to dissuade this Gentleman from compleating his Pursuit, after this great Privilege of Life, now so nearly overtaken, may, if it proceeds from the fear of Danger; be termed *Weak*; but if designedly offered for any other end, must be called extreamly *wicked*.

For my own Part, after so much uncommon Pains taken in this Gentleman's Cure, and the great sollicitude I have undergone for its happy Success, which I had now so far affected, as to have removed all the material Difficulties, that opposed, and have so little remaining, to be farther done; should I be hindred from the Prosecution of those Measures I

have

their ſide, of being attended with their deſired Effects, I ſhould undoubtedly be very ſenſibly affected with the painful Diſappointment, ſince I know of nothing on Earth could afford me greater Pleaſure, than the Recovery of a Gentleman of his Conſequence, and Merit: and it would be prodigiouſly abſurd to imagine, that I ſhould be ſo deſirous of attempting ſuch an important Undertaking, in which my Reputation is ſo viſibly at ſtake, where it not that I have all the Reaſons, I can poſſibly deſire, (and I think I may from my long Experience, and frequent Practice, without vanity, reckon myſelf a tollerable Judge of their Validity) to encourage me to hope for a good and happy Event.

F I N I S.

ON *Monday* the 21ſt of *November* next, about five in the Evening, Dr. TAYLOR will begin a Courſe of Lectures on the Nature and Cure of the DISEASES OF THE EYE (at his Houſe in *Great Queen-Street*, *Lincoln's-Inn Fields*.) Containing, I. An Hiſtorical Account of all that been publiſhed on theſe Diſeaſes, by the moſt celebrated Writers, both Antient and Modern. II. Impartial Examinations, and Remarks on all they have delivered concerning their Cauſes and Cure. III. The Author's own explanation of their Cauſes, together, with a great variety of Circumſtances, diſtinguiſhing thoſe Symptoms, which properly conſtitute each particular Species. IV. His method of curing every Diſeaſe in each Species and State, whether by Medicines or Operations: in which the manner of each Operation, as practiſed by himſelf, is fully diſcribed, its peculiar Advantages clearly ſet forth, and its difference from other Methods, truely demonſtrated and juſtified. All founded on a long Experience and large Practice.

Now

A Treatiſe on the Mechaniſm of the Eye, with ſeveral Plates.

Juſt Publiſhed.

SYllabus Curſus Anatomiæ, Infirmitatum atque Operationum Globi Ocularis, et Partium Contiguarum, D. D. Joſepho Cervy, Regiæ Majeſtatis Catholicæ Præclariſſimo Medico Primario, Meritiſſimoque Præſidi, Proto-Medicatûs Regnorum Hiſpaniæ, &c. Dicatus; à D. D. Joanne Taylor, M. D. Regiſque Magnæ Britanniæ Medico Oculario, Multiſque in Academiis celeberrimis Socio, Authore.

ALSO

TEſtimonia, Seu Atteſtationes, Quibus Cathedratici, cæterique Doctores facultatem Medicinæ profeſſi, Regiæ, inſigniſque Univerſitatis Conimbricæ Luſitaniæ, De operationibus, methodoque oculorum infirmitatibus medendi Joannis Taylor, Medicinæ Doctoris, Britannicæque Maieſtatis Phyſici Ocularii, Atteſtantur, ſuaſque ſententias exponunt, Excelſo D. D. Joanni V. Luſitaniæ Regi Humillime oblata.

ALSO

L'Anatomie du Globe de l'Oeil, avec l'uſage de ſes differentes Parties, & de celles qui lui ſont contiguës. Ornê de planches graveês en Taille douce.

Dê dié â Monſieur le Premier Medicin du Roy de France.

ALSO

AN Impartial Inquiry into the Seat of the Immediate Organ of Sight: *viz.* Whether the *Retina* or *Chorcides*. Being the Subject of a Lecture, in a Courſe lately given on the Nature and Cure of the Diſeaſes of the Eye. To which is annexed, Five and Forty Queries on this Controverted Subject. Submitted to the Examination of the Curious.

All may be had at Mrs. COOPER's, at the *Globe* in *Pater-Noſter-Row*; where alſo may be had the Sentiments of the Foreign Univerſities on Dr. TAYLOR's Succeſs in the curing the Diſeaſes of the Eye.

DISEASES
OF THE
Chryſtalline Humour
OF A
HUMAN EYE:
Or, of the
Cataract *and* Glaucoma.

WITH A

New Theory of their CAUSES, and an Endeavour to demonſtrate that there are no membranous Cataracts; but that all Cataracts are from an Alteration of the chryſtalline Humour itſelf.

WITH

An exact Deſcription of a new and more ſucceſsful Method of making the Operations neceſſary to the Removal of the ſeveral Species of theſe Diſeaſes.

Humbly addreſs'd to Her MAJESTY.

To which is prefix'd,

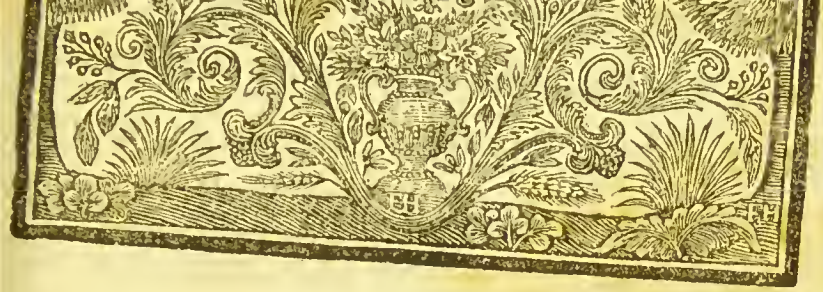
A LETTER to the PHYSICIANS and SURGEONS of *London* and *Weſtminſter*.

Qui dat videre, dat vivere. Cic.

By JOHN TAYLOR, M. D. Oculiſt, FELLOW of the College of Phyſicians of *Baſle* in *Swiſſerland*, of the Imperial Academy of *Cologn* in *Germany*, and of the Society of *Leige* and *Rheims*.

LONDON:
Printed for JAMES ROBERTS, near the *Oxford-Arms* in *Warwick-Lane*. M DCC XXXVI.

1650246



TO THE

QUEEN.

MADAM,

THE great Advantage of a perfect Enjoyment of Sight, and the deplorable Condition of the ind, are ſo obvious, that I need not

make

make an Apology for writing a Treatiſe on this Subject, ſince nothing of the Kind has yet appear'd in our Language worthy the leaſt Notice. And I am ſo much the more encourag'd to publiſh it, that I have the Honour to lay it at your MAJESTY's Feet, who are as capable of judging of its Solidity and Merit, as You are inclin'd to encourage ARTS and SCIENCES; and whoſe great Diſcernment in all Things is equal to thoſe eminent Virtues which have made You the Glory of Your Sex, have added Luſtre to Majeſty, and inwardly adorn'd the Splendor of an outward Crown.

The Honour, MADAM, which I have had to attend Your MAJESTY and

was allow'd to lay before You, permits me to hope that this WORK will have the good Fortune of proving acceptable to Your MAJESTY.

It would, MADAM, be the greateſt Preſumption in me to undertake to celebrate Your MAJESTY's Praiſes, conſcious as I am that I could never riſe up to the Grandeur of the Subject; and therefore it better becomes me to admire with a reſpectful Silence thoſe amiable Qualities that have gain'd Your MAJESTY the Eſteem and Affection of Your People at Home, and made You the Envy

I am,

MADAM,

With the greatest

Respect and Submission,

Your MAJESTY's

most humble and most dutiful

Subject and Servant,

JOHN TAYLOR.

TO THE PHYSICIANS AND SURGEONS OF *London* and *Westminster*.

GENTLEMEN,

OF all the Senses, that of Seeing is allow'd to be most useful; yet 'tis a general receiv'd Opinion, that the Organ destin'd to serve to that noble End, is more exposed to Dangers, more liable Infirmities and Diseases than any other; d that such Diseases are with more Difficulty re-

Use: But I believe the Objection may be soon answer'd, and Nature be found here in no wise to differ from her ordinary Method of acting; if we consider what little Attention has been given to this Branch of Knowledge, and how few have engaged in its Practice.

There is no Doubt but the Cause of this Ignorance arises from the great Nicety that attends its Study, and the little Success that has flow'd from its Practice; if, therefore, from the following Sheets, it may appear I have apply'd myself with more Diligence to the former; or if the Success which I have met with in the latter may be every Day known, I question not, but these will be sufficient Motives to recommend this Piece to your Perusal; and of this I am the more persuaded, because I apprehend, you, who are particularly distinguish'd in the learned World from your Superior Judgment in Physick, can't but be well pleas'd with any Industry, that may be conducive to the improving this most useful, and perhaps only Part, which has been hitherto least known.

Whatever may have been thought of the Method I have taken towards the Advancement of this Science, may be needle

dious Progreſs I have taken, which I find has given to ſome a Cauſe of Objection, has been the only Means and Foundation of my Knowledge and Improvement, as it has furniſh'd me with an Opportunity of making my Remarks upon a greater Number of Subjects, in a few Years, than the whole Series of my Life, in a ſettled Way, could poſſibly have afforded me.

I wou'd be here underſtood, that from the many Experiments I have made during the uninterrupted Courſe of Eight Years (the Time I was on this Progreſs) I have been furniſh'd with thoſe Lights which have enabled me to form a more certain and extenſive Theory than my Predeceſſors could pretend to, or my Contemporaries can boaſt of. And ſurely it muſt be granted, that in all Sciences, that which is ſupported by a Number of inconteſtible Facts, is preferable to that which is only founded upon a precarious, and often chimerical Hypotheſis: Therefore, Gentlemen, I hope, what I have the Honour to preſent you, will be read and examin'd, without the leaſt Regard to any private Ends, but purely in the View of rendring Service to the Publick.

Not

for the Cure of which we have hitherto had no true Method propoſed, and which I have endeavour'd to remedy, by a more eaſy and ſecure Way than has yet been found out; that of the Cataract, as being more general, is, for that Reaſon, more worthy of Remark; eſpecially if we conſider that it has been thought neceſſary to expoſe the Patient to wait ſometimes many Years in a very miſerable State, for the Maturity of it; in hopes of Succeſs from an Operation which has always been acknowledg'd dangerous, and ſo very uncertain, by the ordinary Methods, that 'tis even hard to conceive why it ſhould not rather totally deſtroy the Sight, than prove a Means of its Recovery.

If it ſhall appear from the Succeſs ſome of you have ſeen, and the Account here given of the Manner of my removing theſe Diſorders, that I am the firſt who have diſcover'd the Means to avoid that painful Delay of a Cataract's Maturity, and to remove the ſeveral Species of it with leſs Danger, I hope you will think me worthy your Eſteem, as well as that of the Publick.

y judged Incurable; but if it is evident from my Practice, and in the Progress of this Work, that I have been so happy as to find out a Way of removing several Species of it, I hope, since I explain the Methods, and pretend to no Secret, there will be nothing in this Case that savours of Presumption.

It may not, perhaps, be amiss to observe here, that it has ever been a Custom with the profess'd Oculists of all Nations, to make a Secret of their Practice, and to refuse to communicate to any one a Share of that Knowledge they possess'd. For my Part, I declare publickly my Design of acting in a different Manner, and am so far from desiring to conceal my Practice, that I shall ever use my utmost Endeavours to make it more diffusive and universal.

I am far from affirming, that I have a ompleat Knowledge of all the Diseases of the Eye; and own there are many Things I am nacquainted with: But it may be sufficient ere to recommend my Practice and Theory the Judgment of You, who, from your Edu-ation, can be no Strangers to the Subject; nd I shall beg Leave to finish with this Refle-ion, That whatever Fate attends this Work,

I know

Reason.

I am,

GENTLEMEN,

Your Obedient,

Humble Servant,

Suffolk-Street, Dec. 21.
1735.

JOHN TAYLOR.

ON THE

DISEASES

OF THE

Chryſtalline HUMOUR.

CHAP. I.

Of the CATARACT *in general.*

WHAT the *Greeks* call *Hypochyma*, and the *Latins*, *Suffuſio*, is one and the ſame Diſeaſe, known by the Name of *Cataract*.

Authors are not agreed about the Nature of a Cataract; ſome pretend that it is a Substance of a membranous Appearance, form'd from a diſeas'd Alteration of the aqueous Humour; others, that it is a Subſtance of a membranous Appearance form'd from *Pus*,

 ſeparated

racts, but that all Cataracts are an Alteration of the chryſtalline Humour itſelf.

They who believe that a Cataract is a Subſtance of a membranous Appearance from a diſeas'd Alteration of the aqueous Humour, tell us, That when any impure Particles are emitted into the aqueous Humour of an improper Quality, Figure, or Magnitude, to paſs on in the uſual Circulation; they continue moving about this Humour, till by their Levity or Viſcidity they aſſemble together behind the Pupil, and by degrees obtain the Conſiſtence and Opacity of a Pellicle or Membrane.

If we conſider the Situation and different Quantity of the aqueous Humour in the two Chambers of the Eye, with the manner of its Supplies, we ſhall be encourag'd to believe that ſuch a Subſtance of a membranous Appearance would rather form itſelf in the anterior than in the poſterior Chamber; and ſince we have no Inſtance of a Cataract being form'd in the anterior Chamber, we may very reaſonably conclude that no Cataract can be form'd from any diſeas'd Alteration of the aqueous Humour.

They who believe that a Cataract is a Subſtance of a membranous Appearance form'd from *Pus*, ſeparated by a Loſs of Continuity

poſterior Chamber of the aqueous, which by its Viſcidity adheres to the Circumference of the Pupil, and forms a membranous Cataract.

Experience daily proves the Error of this Hypotheſis; for if we obſerve the different Poſitions of a Cataract in the ſeveral Degrees of its Progreſs, we ſhall perceive that it begins in the Seat of the Chryſtalline, and as its Opacity increaſes, it appears to riſe towards the Center of the Pupil, and that in its laſt State it admits Light to paſs between the Capſula of the Chryſtalline and inner Edge of the Pupil, in a ſufficient Quantity to diſcover Shades of Objects.

Whereas if a Cataract adhered to the inner Edge of the Pupil in all or part of its Circumference, it would not only proportionally hinder the Light from paſſing to the immediate Organ of Sight, but ſtop the free Motions of the *Iris*; and if we ſuppoſe from the Softneſs of its Texture it would not ſtop the Motions of the *Iris*, we muſt allow ſome Change in its Figure, depending on ſuch Motions; and ſince Experience makes it evident that the Cataract maintains very nearly, if not exactly, the Figure of the healthful Chryſtalline in every State of this Diſeaſe, we may very reaſonably conclude

 that

They who maintain that a Cataract is an Alteration of the Chryſtalline Humour, have proved it by ſuch a vaſt Variety of unqueſtionable Experiments, that I think (in the Time I write) 'tis a generally receiv'd Opinion. I ſhall therefore only endeavour to demonſtrate that there are no membranous Cataracts, but that all Cataracts are an Alteration of the chryſtalline Humour itſelf.

The Queſtion is then, Whether there are membranous Cataracts? Or whether all Cataracts are an Alteration of the chryſtalline Humour?

Meſſieurs *Hecquet* (*a*), *Woolhouſe* (*b*), *St. Yves* (*c*), *Hovius* (*d*), *Morand* (*e*), *Geiſler* (*f*), *Gaſtaldi*

(*a*) 1. Remarques ſur l'utilité de la ſaigée dans les maladies des yeux.

2. Sa Lettre ſur les maladies des yeux pour expliquer ce qui en a eté dit dans ſes remarques ſur l'utilité de la ſaignée dans les maladies des yeux.

(*b*) 1. Ses Diſſertations ſçavantes & Critiques ſur la Cataracte & le Glaucome.

2. Ses Obſervations ſur le Memoire Acadêmique de Monſ. *Morand*.

3. Son Memoire dans le Journal des Sçavans, *Decembre*, 1720.

(*c*) 1. Son Traité des maladies des yeux, *p*. 239.

2. Reponſe à une Lettre Critique de ſon Traité des maladies des yeux.

(*d*) De circulari humorum motu in oculis, *p*. 86.

(*e*) Ses Obſervations ſur la Cataracte dans l'hiſtoire de L'academie Royale des Sciences, l'année 1722.

(*f*) Sa Lettre écrite de *Nuremberg* ſur la Cataracte.

oth these Opinions, and assert, that there re membranous Cataracts, but that they are ot so common as those from an Alteration f the Chrystalline.

On the contrary, Messieurs *Heister* (*a*), *Maitre-Jan* (*b*), *Brisseau* (*c*), *Petit* (*d*), with any others, maintain that there are no embranous Cataracts, but that all Cataacts are from an Alteration of the chrystalne Humour.

(*g*) Questio Medico-Chirurgica, *&c.* sub hac verborum ie, an Cataracta à vitio humoris aquei aut crystallini ori-r, *&c.*

(*h*) Sa Lettre écrite à Mr. *Woolhouse*, &c. *Vid.* Journal Sçavans pour le mois de Juillet, 1722.

(*i*) Ses Observations sur la Cataracte & le Glaucome.

(*k*) Suite des Maladies Chroniques V. 5.

(*l*) Dissertatio Medica de Cataracta, *&c.*

(*a*) 1. De Cataracta, Glaucomate, & amaurosi Tractatio, *&c.*

2. Apologia & uberior explicatio systematis sui de Caacta, Glaucomate, & amaurosi, contra *Wolhusii* ocularii *isiensis* cavillationes & objectiones, itemque *Parisiensis* ditor, *&c.*

3. Vindiciæ sententiæ suæ de Cataracta, Glaucomate, mauro si, *&c.*

(*b*) Traité des Maladies de l'Oeil.

(*c*) Traité de la Cataracte & du Glaucoma.

(*d*) 1. Sa Lettre dans laquelle il démontre que le Cristallin ort prés de L'uveé, *&c.*

2. Sa Lettre contenant des reflections sur ce que M. *quet* a dit dans ses Remarques sur l'utilité de la saignée les maladies des yeux.

3. Sur les deux espaces que l'humeur aqueuse occupe l' oeil & sur le Cristallin & la Cataracte. V. Histoire de l' demie Royale des Sciences pour l'anneé 1722, 23, 25, 30.

the Exiſtence of a membranous Cataract; in order to determine this Queſtion, I ſhall enquire into the exact Situation of the Chryſtalline, the true Depth or Thickneſs of the Chambers of the aqueous Humour, and the Conſequences that muſt attend the Removal of this ſuppoſed membranous Cataract from he poſterior Chamber.

The celebrated *Dr. Petit* greatly favour the Opinion which maintains that all Cataracts are from an Alteration of the chryſtal line Humour, as appears in ſeveral of th Memoirs of the Royal Academy of *Paris* and he ſupports this Opinion chiefly fron his having proved by the following Experi ment the exact Situation of the Chryſtallin and Thickneſs of the Chambers of the aque ous Humour.

He ſeparated a human Eye from its Fa and Muſcles, and in that Situation it weigh ed 147 Grains and a half, and its Axis wa 11 Lines one Third of Length; this Ey was a little flat on its Sides, under the ſtra Muſcles, which made four irregular obtu Angles; it had 11 Lines one quarter, me ſur'd by two of its oppoſite flat Sides, fro the Right to the Left, and 10 Lines o quarter by two of its oppoſite flat Side from the ſuperior to the inferior Parts.

T

)iameter meafur'd from the exterior Part of ıe *Cornea.* But five Lines and a half when ıeafur'd from the interior Part of the *Cor-ea*, where the *Cornea* grows wider, by rea-ɔn of its Inclination.

The Pupil had one Line and a half of)iameter, this was remarked after the Re-ıoval of the *Cornea*, which had the Thick-efs of $\frac{1}{12}$ of a Line. The *Cornea* and aque-us Humour being removed, he took away ith a fine Sponge, all that remain'd of the queous Humour about the Surface of the apfula of the Chryftalline.—He weigh'd ıis Eye, and found lefs Weight by five rains, which was the Weight of the aque-ıs Humour this Eye contain'd.—He then eafur'd the Axis of the Eye, and found it ne Lines $\frac{2}{3}$, that is, one Line $\frac{2}{3}$ from the oft prominent Part of the *Cornea*, to that the Capfula of the Chryftalline; from hich, if we allow $\frac{1}{12}$ for the Thicknefs of e *Cornea*, the Thicknefs of the aqueous hambers will be exactly one Line $\frac{1}{2}$.

The Chryftalline formed by its anteri- Part a Portion of a Sphere, of nine nes in Diameter; it had four Lines $\frac{1}{2}$ in gnefs, and two Lines $\frac{1}{4}$ in Thicknefs; the eight of its Segment, had a little more an $\frac{1}{5}$ of a Line.

ceſſus ciliares. This Capſula confin'd th Chryſtalline in the Cavity of the Vitreou Humour; it did not adhere to any Part c the Chryſtalline, but was (as it always is) mo ſtened with a little quantity of Liquor.—Th Chryſtalline weighed four Grains $\frac{1}{4}$.

The vitreous Humour which fill'd all th reſt of the Eye, weigh'd ten Grains.— Th Membranes weigh'd thirty-four Grains. I we put together the Weight of each c theſe Parts, the Total will be 147 Grai and a half for this Globe of the Eye.

There are ſeveral other ways of knowin the true Situation of the Chryſtalline, an Thickneſs of the aqueous Chambers. If w make an Opening into the right Side of th Globe, with the Point of a Lancet, abo three Lines below the Edge of the *Corne* and another in the oppoſite Side, exactly the ſame Diſtance from the *Cornea*; if aft having enter'd a Needle at one of theſe Ope ings, and paſs'd it in a direct Line thro' th other, we cut round the *Sclerotis* immed ately below the *Cornea*, remove the *Uve* open the Capſula of the Chryſtalline, ar take the Chryſtalline from its Seat, we ſha perceive that the Needle has paſs'd the poſt rior Part of the Chryſtalline, without havi touch'd the Chryſtalline in its Paſſage.

Edge of the *Cornea*, and another in the oppoſite Side, exactly at the ſame Diſtance from the *Cornea*; if after having enter'd at one of theſe Openings a ſmall *plano*-Convex Needle, with its plain Surface directed towards the fund of the Globe, and paſs'd it, in a direct Line, through the other, we cut round the *Sclerotis*, immediately below the *Cornea*, and remove the *Uvea*, we ſhall perceive the plain Surface of the Needle immediately placed on the anterior Surface of the Capſula of the Chryſtalline,

And we may determine with great Exactneſs, the Thickneſs of the aqueous Chambers, by examining with Attention the Origine, and Inſertion of the *Ligamentum ciliare*, and remembering that this Ligament never exceeds $\frac{3}{4}$ of a Line in Length.

By theſe Experiments, we learn the impoſſibility of removing this ſuppoſed membranous Cataract from the poſterior Chamber of the Aqueous, without violenly breaking or ſeparating the *Ligamentum ciliare* from its Adheſion to the Capſula of the Chryſtalline.

And by theſe Experiments we learn, that if to avoid breaking or ſeparating the *Ligamentum ciliare*, in an Endeavour to remove

this

its Insertion, to the Capsula of the Chrystalline, we must make such an Opening into the posterior and anterior Parts of this Capsula, as to render it incapable to continue the Chrystalline in its healthful Seat. — Thus the Chrystalline being no longer confined in its Capsula, would leave its Situation in the *Vitreous*, and fall on the *Uvea*.

But even this Care is never taken by those who favour the Existence of a Membranous Cataract; for by what I have seen, and by all the Accounts that have come to my Knowledge, the Operation which has ever been universally practised, consists only in passing a Needle a little behind the *Cornea*, and directing it to the superior Part of the Cataract, and afterwards in endeavouring to place the Cataract a little below the inferior and inner Surface of the *Uvea*. Thus from the above Experiments it appears, That the Needle must act as much in the Seat of the Chrystalline, as in the aqueous Chamber, and consequently must act as much on the Chrystalline, as in this supposed Membrane.

And suppose the Needle was enter'd into the Posterior Chamber of the aqueous, without wounding the *Ligamentum ciliare*, or Capsula of the Chrystalline, it will be very difficult to conceive how a Needle of $\frac{1}{3}$ of a Line in its Diameter, should move in

the Removal of this ſuppoſed
Cataract; ſince it appears by the moſt exact Enquiry, that the Thickneſs of the poſterior Chamber of the aqueous never exceeds $\frac{1}{4}$ of a Line, when the aqueous Humour, (which is at this Time diſcharged) is contained in it.

From what I have ſaid it appears, that thoſe who favour the Exiſtence of a membranous Cataract, muſt not only neceſſarily admit of a different manner of removing it, from that of a diſeaſed Chryſtalline, but alſo have ſome certain way of knowing the one from the other. —— For if before the Operation they ſhould judge it a Cataract, from an Alteration of the Chryſtalline, when it was a Membrane in the poſterior Chamber of the aqueous: By endeavouring to remove this Cataract, they muſt effectually deſtroy the healthful Chryſtalline, by forcing it through its Capſula, or forcing it with its Capſula, from the *Ligamentum ciliare.* And, ſuppoſe, during the Progreſs of ſuch an Operation, they find their Miſtake, and immediately return their Needle into the ſuperior Part of the poſterior Chamber of the aqueous, in order to remove this ſuppoſed Membrane, it would be impoſſible for them, (as I have already obſerved) to paſs the Needle into that Seat of the aqueous, without violently breaking or ſepara-

ting

and the aqueous Humour being discharged, the Chrystalline, with its Capsula, must necessarily fall on this supposed Membrane, and force it so irregularly on the *Uvea*, that no Endeavours could remove it, without destroying the Uses of the Chrystalline, and exposing the Patient to great Danger.

Thus they would not only be effectually disappointed of any immediate Success, but in all Probability occasion an irrecoverable Loss of Sight.

And if before the Operation, they should judge it a Cataract, from an Alteration in the posterior Chamber of the Aqueous, when it was a diseased Chrystalline; by endeavouring to remove this Cataract, they must so change the healthful Situation of the diseas'd Chystalline, or force it through its Capsula on the *Uvea*; that on finding their Mistake, it would be impossible for them to depress this alter'd Chrystalline, without exposing the Patient to the utmost Danger.

And if it appear'd that they had any certain Signs of knowing this Membranous Cataract, from that of a diseased Chrystalline. The Situation of the Chrystalline, its Capsula and *Ligamentum ciliare.* — The Smallness of the posterior Chamber of the Aqueous. — The Impossibility of moving a Nee-

the *Uvea*, in the Progreſs of the Operation from the Diſcharge of the aqueous Humour. — The wounding or forcibly ſeparating the Parts of the *Ligamentum ciliare*, and the Change that muſt neceſſarily happen in the Situation of the Chryſtalline, ſufficiently prove that Sight could never be reſtor'd by any Operation poſſible to be attempted to remove this ſuppos'd Membrane; but on the contrary, every ſuch Attempt muſt bring on the moſt dangerous Conſequences.

By this way of Reaſoning I was at firſt inclined to believe, that all Cataracts were from an Alteration of the Chryſtalline; and was afterwards ſtrengthned in my Opinion, from the vaſt Number of Errors in the Sentiments of thoſe who favour the Exiſtence of a membranous Cataract. And my Opinion receiv'd further Support, from having never found any Alteration in the poſterior Chamber of the Aqueous, that had the leaſt Analogy to the Account we have of a Membranous Cataract; but have always remarked in examining the Pupil, from the firſt Appearances of every Species of this Diſeaſe, Degrees of Whiteneſs, and Opacity in the Seat of the Chryſtalline; and that in the Progreſs of their Symptoms, this Whiteneſs

and

actly, the Figure of a healthful Chryſtalline.

Beſides, if a Cataract could be formed by any Alteration in the poſterior Chamber of the Aqueous, I might reaſonably have expected to have ſeen one Inſtance in ſuch a vaſt Number of Diſorders of this Kind, which have preſented to my Care; and I muſt of Neceſſity have known it from that of a diſeas'd Chryſtalline, from its Figure, Situation, and Opacity, conſider'd from the Make of the poſterior Chamber of the aqueous.

Since therefore not one Inſtance of a membranous Cataract has preſented to my Obſervation, notwithſtanding I have been long favour'd with a very extenſive Practice in the Diſeaſes incident to the Eye; and that if ſuch an Inſtance could be found, it appears impoſſible to account for its Formation, or to remove it, without effectually deſtroying the eſſential Parts of Sight, I am perſuaded that there are no Cataracts but what are from an Alteration of the chryſtalline Humour.

CHAP.

CHAP. II.

Of the Definition of the Cataract.

BY a Cataract I underſtand a diſeas'd Alteration of the Chryſtalline, attended with Degrees of an unequal Opacity and Colour, Loſs of Diameter, preternatural Change of its Conſiſtence, Magnitude, Figure, Gravity, and Situation, where the Chryſtalline maintains one unequal Continuity, while thro' all its Parts its Capſula ſtill continues to have its healthful Tranſparency; and in another State of it, it has Degrees of equal Opacity and Colour, Increaſe of Diameter, preternatural Change of its Conſiſtence, Gravity, and Situation; and here the Chryſtalline ſuffers a Solution of Continuity in ſome or all of its Parts, with a diſeas'd Alteration of its Capſula. The former I call the true, and the latter the falſe Cataract.

CHAP.

CHAP. III.

Of the Causes of the several Species of the true Cataract.

AUthors are not agreed about the Causes of the true Cataract; some pretend that it is owing to Degrees of a preternatural Viscidity, in that Fluid brought for the Supplies of the Chrystalline, which by possessing Particles of an improper Magnitude, may be so irregularly lodg'd in its Vessels, as to destroy that Equality so necessary to Transparency. Others, on the contrary, deduce this Opacity of the Chrystalline from an Inflammation of the Blood, and preternatural increas'd Momentum of that Fluid with which the Chrystalline is supply'd; for in that Case gross Particles, inconsistent with Transparency, may be impell'd into the lymphatick Vessels, of which it is compos'd. And others attribute this diseas'd Alteration of the Chrystalline, to a Defect in that Liquor which is found between the Chrystalline and its Capsula, and observe, that when the Vessels intended to convey the Supplies to the Chry-

the Alterations obſervable to attend the ſeve-
ral Species of this Diſeaſe.

Since this Diſeaſe happens to thoſe who
are the moſt healthful and temperate, and
the moſt free from viſcid or inflam'd Blood,
great Variety of Objections muſt neceſſarily
be remov'd to make any of theſeOpinions
reaſonable; which has induc'd me to be-
lieve, that theſe Diſeaſes are owing to a pre-
ternatural, forcible, and irregular Contra-
ction of any one or more of the Muſcles of
the Globe, by which the Parts of the Chry-
ſtalline are more or leſs violently and irregu-
arly preſs'd; and that the Degrees of their
Conſiſtence, Magnitude, Figure, Colour,
Gravity, Situation, and Opacity, depend on
the Degrees of Strength, and Uniformity of
his Preſſure; and that the Cauſe of this
preternatural, forcible, and irregular Con-
traction of any one or more of the Muſcles
of the Globe, is owing to the Deficiency of
the Supplies of that Fluid, ſo neceſſary to
their Senſation and Motion; and that the
Cauſe of the Deficiency of ſuch Supplies, is
owing to a long, conſtant Direction of the
axis of the Eye to particular Objects, by re-
quiring in a limited Time a greater Supply
to particular Muſcles of the Globe, than

what

of the Globe, may occaſion ſuch Muſcles to act with a degree of Strength different from thoſe which act in Oppoſition to them; whence follows an Irregularity in the general Action of all theſe Muſcles.

From this preternatural Action of theſe Muſcles, the Globe ſuffers different Changes in its Figure, by which the ſeveral Parts of its Contents are differently forced from their healthful Situation; and the *Ligamentum Ciliare* being fix'd to the Circumference of the Capſula of the Chryſtalline, and the aqueous Humour lying immediately on the anterior Parts of this Ligament, and the vitreous on its poſterior; the chryſtalline Humour being thus confin'd in its Capſula, between the two Surfaces of theſe Humours, the preternatural Preſſure which is thus made on them, muſt neceſſarily be continu'd to the two Surfaces of the Capſula and the Chryſtalline; and in proportion to the Degrees of Strength, and Uniformity of this Preſſure, the Chryſtalline muſt not only ſuffer a diſeas'd Alteration in ſome or all of its Parts, but the whole Chryſtalline muſt be chang'd from its healthful Situation in its Capſula.

From the Degrees of the Irregularity and Force of this preternatural Preſſure, with the

Progress of each Species of this Disease.

That the preternatural, forcible, and irregular Contraction of one or more Muscles of the Globe, is the Cause of the several Species of the true Cataract, is further evident from those Alterations of the Chrystalline which sometimes succeed a Blow receiv'd near the Eye; for the Alterations of the Figure of the Globe, from the irregular and violent Action of any one or more of its Muscles in such a Case, are the same in a greater degree, as the irregular and violent Action of any one or more of these Muscles arising from any other; because from the violent, sudden and irregular Change of the Figure of the Globe arising from this Blow, the Chrystalline is press'd with such Violence towards the *Uvea*, as not only to change it from that Situation in its Capsula so necessary to receive its Supplies, but also to force it into the posterior Chamber of the Aqueous; thus there is such an entire Stop put to the healthful Circulation of the fluid Contents of the Chrystalline, and such a Change made in the Continuity of its Parts, that all the Parts of the Chrystalline immediately obtain a greater degree of Opacity than would have happen'd in a long time by a less Degree of this Pressure, where the Chrystal-

and so call'd from its continually changing its Situation behind the *Uvea*.

That the preternatural, forcible, and irregular Contraction of any one or more of the Muſcles of the Globe is the Cauſe of the ſeveral Species of the true Cataract, is further evident from obſerving that it always affects ſuch as have employ'd much Time in reading, or viewing particular Objects.

CHAP. IV.

Of the diagnoſtick and prognoſtick Signs, and Cure of the ſeveral Species of the true Cataract.

THE diagnoſtick Signs of the ſeveral Species of the true Cataract are known from the Situation, Colour, and Degrees of an unequal Opacity of the anterior Surface of the diſeas'd Chryſtalline.

In the firſt State of this Diſeaſe, we perceive Degrees of a ſmall Cloudineſs more im-

And the reaſon of this ſmall Cloudineſs or Opacity appearing near the Center of the Seat of the Chryſtalline, is from the central Diameter of the Chryſtalline being greater, and conſequently containing a greater Number of theſe alter'd Parts.

In the ſecond State of this Diſeaſe, we perceive the Opacity of the Chryſtalline to be increas'd, and to be continu'd thro' all the Seat of the Chryſtalline, but more immediately in its Center, to maintain the healthful Figure of the Chryſtalline, to be advanc'd towards the Center of the Pupil to near half the Thickneſs of that Part of the poſterior Chamber of the aqueous, between the inner Edge of the Pupil and the moſt prominent Part of the Capſula of the Chryſtalline, to have degrees of a Mixture of a pale white and blue Colour, and to continue to impower the Patient to ſee Shades of Objects in a Direct Line from the Axis of the Eye.

In the laſt State of this Diſeaſe we perceive the Opacity of the Chryſtalline to be greatly increas'd, and to be very unequal in all its anterior Parts, to maintain very nearly the Figure of the healthful Chryſtalline; to be ſo conſiderably diminiſh'd in its Volume, as to have the Thickneſs of that Part of the Poſterior Chamber of the aqueous, between the inner Edge of the Pupil and the moſt

to have degrees of a Mixture of various Colours, and to permit a ſufficient Light to paſs between the Edge of the Pupil and anterior Circumference of the Capſula of the Chryſtalline, ſo as to impower the Patient to ſee Shades, Colours, and ſometimes the Figures of many Objects.

The prognoſtick Signs of this Diſeaſe being curable, depend in general on the Perfection of the immediate Organ of Sight; and even in its firſt State it is ſeldom remov'd without the Operation.

To remove the firſt Symptoms of this Diſeaſe, I only recommend the Patient to abſtain from all ſuch Work as may command great Attention of Sight, ſuch as reading, writing, ſewing, *&c.* to keep the Eye from receiving Light from any very luminous Object, and to cauſe a Shade to be fix'd before the Eyes ſo as to prevent the Light from falling immediately within the Axis of the Eye.

The ſecond and laſt State of this Diſeaſe will admit of no Remedy but the Operation.

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CHAP. V.

Of the Causes of the several Species of the false Cataract.

THese diseas'd Alterations of the Chrystalline are always preceded by an apparent Plenitude, Distention, and preternatural Change of the Contents of the sanguine and lymphatick Arteries in all the Parts of the Globe, arising from some diseas'd Alteration of the Blood, by which its Momentum is so increas'd as to force into the Vessels of the Chrystalline (from the Extremities of those Arteries employ'd in the Service of their Supplies) certain Particles of an improper Quality to maintain their healthful Continuity.

And from the different Quality and Number of these diseas'd Particles, some or all the Parts of the Chrystalline pass thro' such various diseas'd Alterations of Plenitude, Solution of Continuity, and Opacity, as to have some, or all of its Parts, chang'd into the Consistence of Milk, Cream, and sometimes of a Matter which has some Analogy in its

of the Capſula, as to render it opake; and this alter'd Chryſtalline being contain'd in its Capſula as in a Bag, has obtain'd various Denominations, ſuch as, *the bag*, *the milky*, and *the purulent Cataract*.

CHAP. VI.

Of the diagnoſtick and prognoſtick Signs, and Cure of the ſeveral Species of the falſe Cataract.

THE preceding *Opthalmia* being entirely removed, the Patient continue to complain of Degrees of Pain from Light and of a very great Diminution of Sight: on examining the Pupil, we perceive Degrees of a ſmall Opacity continu'd thro' th whole Seat of the Chryſtalline, and that thi Opacity maintains the Figure of the healthful Chryſtalline, and is of a clear blueiſ Colour.

In the ſecond State of this Diſeaſe the Patient complains of ſuch a Defect of Sight, t

the Pupil, we perceive the Opacity of the Chryſtalline to be very greatly increas'd, to continue maintaining the healthful Figure of the Chryſtalline, and to be advanc'd towards the Center of the Pupil to near half the Thickneſs of that Part of the poſterior Chamber of the aqueous, between the inner Edge of the Pupil and the moſt prominent Part of the Capſula of the Chryſtalline, and to have Degrees of a white and blue Colour.

In the laſt State of this Diſeaſe the Patient complains of ſuch an entire Loſs of Sight, as to be only ſenſible of a very little Light to paſs between the inner Edge of the Pupil and Circumference of the Capſula of the Chryſtalline, but not ſufficient to diſcover the Shade or Colour of any Object; on examining the Pupil, we perceive the alter'd Chryſtalline to be ſo conſiderably increas'd in its Volume, as to appear to be immediately placed on the inner Edge of the Pupil; to continue maintaining the Figure of the healthful Chryſtalline, and to be of a dark white and yellowiſh Colour.

The prognoſtick Signs of Cure in this Diſeaſe are always very doubtful, and any Remedy very precarious, according to the different Temperament of the Patient, and the Probability of being injudiciouſly treated.

To

ly bleeding of the Temporal Artery, Cupping behind the Ears, *&c.* with the Assistance of Collyriums, and spirituous Fomentations with Camphire, — to keep the Eyes from receiving Light from any very luminous Objects, and to cause a Shade to be so fix'd before the Eyes, as to stop the Light from falling immediately within the Axis of the Eye.

CHAP. VII.

Of the Definition of the Glaucoma.

BY a *Glaucoma* I understand a diseas'd Alteration of the Chrystalline, where the Chrystalline maintains one exact equal Continuity thro' all its Parts, with a diseas'd Alteration of its Capsula, attended with degrees of a very equal Opacity and Colour, very great Increase of Diameter, preternatural Change of its Consistence, Gravity, and Situation; and in its last State with an Elevation, Dilatation, and Immobility of the Pupil, and *Gutta Serena.*

CHAP.

CHAP. VIII.

Of the Cauſes of the ſeveral Species of the Glaucoma.

THeſe diſeas'd Alterations of the Chryſtalline are always preceded by a preternatural Viſcidity of the Blood; and are owing to the Degrees of the Quantity, Momentum, and Viſcidity of that Fluid brought for the Supplies of the Veſſels of the Chryſtalline.

And from the Degrees of the Quantity, Momentum, and Viſcidity of this Fluid, all the Veſſels of the Chryſtalline ſuffer various Degrees of an equal Plenitude, Opacity and Colour, till the Circulation of their Contents entirely ceaſe.

And this preternatural Plenitude of the Contents of theſe Veſſels by degrees ſo increaſes the Volume of the whole Chryſtalline, as to place its anterior Surface immediately behind the inner Circumference of the Pupil.

And in a further Increaſe of the Plenitude of the Contents of theſe Veſſels, the Volume of the Chryſtalline is ſo greatly augmented,

as

And by this great Increaſe of the Volume of the Chryſtalline, the Plenitude of the Globe is ſo greatly augmented, as to occaſion Degrees of a preternatural Preſſure on the immediate Organ of Sight.

And this preternatural Preſſure on the *Uvea* and immediate Organ of Sight, is attended with Degrees of a violent Pain immediately in the Fund of the Globe, which continues in degree till in the laſt State of this Diſeaſe there is a Stop put to the Circulation of the Contents of the Veſſels of the Chryſtalline, and conſequently to the Augmentation of it, and Plenitude of the Contents of the whole Globe.

CHAP. IX.

Of the diagnoſtick and prognoſtick Signs, and Cure of the ſeveral Species of the Glaucoma.

WHEN the Patient begins to complain of a Diminution of Sight, on inſpecting the Pupil, we perceive Degrees

ſo increas'd, as to appear immediately plac'd behind the inner Circumference of the Pupil.

In the ſecond State of this Diſeaſe, the Patient complains of Degrees of the moſt violent Pain in the fund of the Globe, and of ſuch a Diminution of Sight, as to be unable, from any Direction of the Axis of the Eye, to ſee more than the Shades and Colours of certain Objects. On examining the Pupil, we perceive the Volume of the Chryſtalline to be ſo greatly augmented, as to have raiſed the Circumference of the Pupil towards the *Cornea*, to near $\frac{1}{4}$ of the healthful Thickneſs of the anterior Chamber of the aqueous, that the alter'd Chryſtalline continues to maintain its healthful Figure, and appears of a dark bluiſh Colour.

In the laſt State of this Diſeaſe, the Patient complains no longer of Pain, but of ſuch an entire Loſs of Sight, as to be even inſenſible of Light. On examining the Pupil, we perceive the Chryſtalline to be ſo greatly augmented in its Volume, as to have raiſed the Circumference of the Pupil towards the *Cornea*, to near $\frac{1}{3}$ of the healthful Thickneſs of the anterior Chamber of the Aque-

Diſeaſe are always exceeding dangerous, and never admit of any certain Remedy for the Recovery of Sight, but in its firſt State; and then only from the Operation.

However, the Cure may be attempted in its firſt State, by a warm attenuating medicinal Diet, Bleeding, Cupping, repeated Emeticks, *&c.* with the Aſſiſtance of Colliriums, and Spirituous Fomentations, — to keep the Eyes from receiving Light from any very luminous Objects, and to cauſe a Shade to be ſo fix'd before the Eyes, as to keep the Light from falling immediately within the Axis of the Eye.

The ſecond and laſt State of this Diſeaſe, will admit of no Remedy, for the Recovery of Sight; and the palliative Cure conſiſts in an attenuating Medicinal Diet, warm Bathing, Bleeding in the temporal Arteries, Cupping behind the Ears, *&c.*

CHAP.

CHAP. X.

Of the Regimen neceſſary to precede my new Operations for the ſeveral Species of the true Cataract, and the ſeveral Species of the Cataract called the ſhaking Cataract. --- For the ſeveral Species of the falſe Cataracts, and the ſeveral Species of that State of the Glaucoma, *where the* Iris, *and immediate Organ of Sight, maintain their healthful State.*

SINCE a perfect Knowledge of the Animal OEconomy, is in no Caſe more required, than in the Treatment neceſſary to theſe Operations, (which, of all others, are infinitely the moſt difficult, and attended with the greateſt Variety of Accidents)

cuations ſome Days before the Operation.

Of the Manner of making my New Operations neceſſary to the Removal of the ſeveral Species of the true Cataract, and the ſeveral Species of the Cataract call'd the Shaking Cataract. For the ſeveral Species of the falſe Cataract, and for the ſeveral Species of that State of the Glaucoma, *where the* Iris *and immediate Organ of Light maintain their healthful State.*

CHAP.

CHAP. XI.

Of the Manner of making my New Operation for the ſeveral Species of the true Cataract.

HAving plac'd my Patient in the uſual Poſition, I fix my Speculum, and ith a Lancet make a ſmall Longitudinal ciſion, of about half a Line in Length, rough the outward and inward Membranes the Globe, into the vitreous Humour. I ake this Inciſion about one Line and a half low that Part of the lateral and outward lge of the *Cornea*, ſituated about two nes below a Line drawn Parallel to the eater and leſſer *Canthus* of the Eye. I en paſs, in a perpendicular Direction to e Globe of the Eye, a *plano*-Convex edle of about one ſixth of a Line in icknefs, through its moſt Convex Part, d one third of a Line in its greateſt Dia- ter, with its Convex Surface towards the erior Part of the Orbit, into the Open-

Vitreous, then very ſlowly bring my Needle forward with its Surfaces in the ſame Direction, 'till its Point is brought about a Line below a Line drawn Parallel to the inferior Inſertions of the *Ligamentum Ciliare*, with the Capſula of the Chryſtalline, and about the ſame Diſtance from the Capſula. I then continue my Needle about one Line forward, in the ſame Direction, and thus paſs its Convex Surface, under the inferior Surface of the Capſula of the Chryſtalline, about a Line below it, and about the ſame Diſtance below the inferior Inſertions of the *Ligamentum Ciliare.* I then gently raiſe my Needle in the ſame Direction, 'till its Convex Surface ſuffers ſome ſmall Reſiſtance from the Chryſtalline, which I judge with grea Exactneſs, by inſpecting the Pupil, an obſerving a Motion in the alter'd Chry ſtalline. And being thus aſſured that th Convex Part of my Needle is placed imme diately under ſome Part of the Capſula o the diſeas'd Chryſtalline, I gently rai the Chryſtalline about a third or fourth Par of a Line, to learn, with ſome Exactneſ on what Part of the Capſula the Conve Part of my Needle is placed; and if on in ſpecting the Pupil, I perceive that the ar

teri

recedes farther from it, I very ſlowly continue my Needle towards the inferior Part of the Globe, with its Surfaces in the ſame Direction, and its anterior Edge at the ſame Diſtance from the inner Surface of the *Uvea*, and Inſertions of the *Ligamentum Ciliare*, 'till I judge the Convex Part of my Needle, about the ſame Diſtance below the inferior Surface of the Capſula, and Inſertions of the *Ligamentum Ciliare*, as it was immediately preceding its being firſt placed under this Capſula. I then replace the Convex Surface of my Needle, on the inferior Surface of the Capſula of the Chryſtalline, nearer or farther from the inferior and inner Surface of the *Uvea*, or nearer or farther from the Inſertions of the *Ligamentum Ciliare*, according to the Direction I received from the Motion of the alter'd Chryſtalline: And when I find by ſuch a Motion, that the Convex Surface of my Needle is ſo exactly placed under its Capſula, that on raiſing it towards the ſuperior Part of the Orbit, the anterior Surface of the Capſula of the Chryſtalline would be continued, in a direct Line, at the ſame Diſtance from all the inner Surface of the *Uvea*: I again raiſe the Chryſtalline about

faces in the ſame Direction and Diſtance from the ſuperior and inferior Part of the Globe, and thus permit the inferior Surface of the Capſula of the Chryſtalline to return to its former Situation. — The moſt prominent Part of the inferior Surface of this Capſula, being now about the ſame Diſtance below the Point of my Needle, as it was raiſed from its Situation by the Convex Part of it, I direct the Point of my Needle, with ſome Violence, about two Lines forward, with its Surfaces at the ſame Direction and Diſtance from the ſuperior and inferior Parts of the Globe: And thus the Point of my Needle paſſes through the Capſula and Chryſtalline, about a Line forward from its Entrance. I then forcibly break through thoſe Parts of the Chryſtalline, and its Capſula, over which my Needle is placed, and thus make an Opening in the inferior Part of the Capſula; obſerving by this Action, that my Needle forcibly enters about two Lines into that Part of the Vitreous. — I then withdraw my Needle about three Lines in the ſame Direction it falls in, and gently raiſe its Point towards the ſuperior Part of the Globe, about a Line above a Line drawn parallel to the ſuperior and lateral Surface of the Capſula of the Chryſtalline,

orward, with its Surfaces in the ſame Di-
ection, 'till I judge its Point be about a
ine above the moſt prominent Part of the
uperior Surface of the Capſula. I then
ently raiſe my Hand, 'till the inferior
urface of my Needle ſuffers ſome ſmall
eſiſtance from the Chryſtalline; which I
dge of, as before, with great Exactneſs,
y inſpecting the Pupil, and obſerving the
Motion of the alter'd Chryſtalline. And be-
g thus aſſured that the plain Surface of
y Needle is immediately placed on ſome
art of the ſuperior and lateral Surface of
e Capſula of the Chryſtalline, I gently
preſs the Chryſtalline about a third or
urth Part of a Line, to learn, with ſome
xactneſs, on what Part of the Capſula my
eedle is placed: And if on inſpecting the
upil, I perceive that the anterior Surface
the Chryſtalline is not continued, in a
rect Line, at the ſame Diſtance, from all
e inner Surface of the *Uvea*, but approaches
arer to, or recedes farther from it; I very
wly raiſe my Needle towards the ſupe-
r Part of the Globe, with its Surfaces in
e ſame Direction, and its anterior Edge at
e ſame Diſtance from the ſuperior and
her Surface of the *Uvea*, and Inſertions
the *Ligamentum Ciliare*, 'till I judge the
ain Surface of my Needle about the ſame

face of the Capsula
and Insertions of the *Ligamentum Ciliare*,
as it was immediately preceding its being
placed on this Capsula. — I then replace
the plane Surface of my Needle, on the
superior and lateral Surface of the Capsula
of the Chrystalline, nearer or farther from
the superior and inner Surface of the *Uvea*,
or nearer to, or farther from the superior and
lateral Insertions of the *Ligamentnm Ciliare*,
according to the Direction I received from
the Motion of the alter'd Chrystalline;
and when I find by the Motion of the
alter'd Chrystalline, that the plane Surface
of my Needle is so exactly placed on its
Capsula, that on continuing it towards the
inferior Part of the Orbit, the anterior Sur-
face of the Capsula of the Chrystalline
would be continued in a direct Line, at the
same Distance from all the inner Surface of
the *Uvea*; I again depress the Chrystalline
about half a Line towards the inferior Par
of the Globe; and by this Motion o
my Needle, I enlarge the Opening I mad
in the inferior Part of the Capsula. I the
once more very slowly raise my Needle to
wards the superior Part of the Globe, wit
its Surface in the same Direction, and i
anterior Edge at the same Distance from th
superior and inner Surface of the *Uve*
and Insertions of the *Ligamentum Ciliar*

e plane Surface of my Needle, about a ne farther towards the poſterior Part of e Capſula, or about a Line farther from e ſuperior Inſertions of the *Ligamentum liare.* My Needle thus placed, I conti- e it very ſlowly, directing its plane Sur- e immediately towards the Opening I de in the inferior Part of the Capſula of e Chryſtalline; and when I have thus for- ly paſs'd the greater Circumference of e diſeaſed Chryſtalline, the remaining Part it inſtantly follows. Thus the alter'd ryſtalline falls into thoſe Parts of the Vi- ous through which I paſs'd my Needle, er having broke through the inferior ts of the Chryſtalline, and its Cap- a.

During this Change of Situation of the r'd Chryſtalline, I continue the plane face of my Needle on the ſuperior and terior Part of its Capſula, till I perceive n its Paſſage on the Capſula about the ter of the Axis of the Eye, when inſtant- raiſe the anterior Edge of my Needle to- ds the ſuperior Part of the Orbit, and in Direction paſs it with great Exactneſs ind the inferior Surface of the *Uvea.* My dle thus plac'd, with great quickneſs, I its plane Surface towards the inferior

My Needle thus plac'd on the present supe-
rior Surface of the Chrystalline, I instantl
direct its anterior Edge towards the inferio
Part of the inner Surface of the *Uvea*; an
by thus changing the Direction of my Nee
dle, its plane Surface is brought about th
same distance towards the present anterio
Surface of the alter'd Chrystalline. Th
plane Surface of my Needle being now ob
liquely situated on the posterior Part of th
Globe, I continue my Needle in the sam
Direction to about a Line below a Lin
drawn parallel to the Center of the Glob
and thus place the Chrystalline near the in
ferior and lower Parts of the *Vitreous.* —
continue my Needle about a Minute th
plac'd on the present anterior Surface of th
diseas'd Chrystalline; and after raising th
Needle's anterior Edge, till its convex Surfac
is immediately directed towards the superi
Part of the Orbit, I very slowly take it out
the Eye in the same Direction.

By thus passing the diseas'd Chrystallin
thro' the Opening I made in its Capsula, th
superior Part of this Capsula being suspen
ed by its Adhesions to the *Ligamentu*
Ciliare, the superior and posterior Parts of th
alter'd Chrystalline pass with great Facilit
from under its Capsula, not only because
th

necessarily comes forward with some degree of Force, to give place for the sudden Reception of the alter'd Chrystalline.

And from this slow and regular Passage of the alter'd Chrystalline thro' the Opening I made in its Capsula, the concave *Vitreous* must necessarily change its Situation, and rise with great Exactness immediately behind the superior and posterior Surface of this Capsula.

The Chrystalline being thus pass'd out of the Axis of the Eye, and the superior and posterior Parts of its Capsula thus forc'd on the superior and inner Surface of the anterior, it is thus the anterior, and Part of the Circumference of the posterior Part of the Capsula, become immediately seated before the Membrane of the now convex *Vitreous*; and thus the Figure of the now convex *Vitreous* is the same with that of the healthful Chrystalline.

If we believe that the *Ligamentum Ciliare* is in any manner necessary to our seeing Objects at different Distances, whether from altering the Figure, or changing the Situation of the Chrystalline; such Uses of it are very nearly preserv'd after this Operation, as in a healthful Eye; for the diseas'd Chrystalline thus pass'd thro' an Opening in its Capsula, and the *Ligamentum Ciliare* maintaining

its

ful Plenitude; it follows that the *Ligamentum Ciliare*, by altering the Convexity of the Capſula, muſt neceſſarily place the Surface of the convex *Vitreous* nearer to, or farther from the immediate Organ of Sight, with very nearly, if not exactly, the ſame Degrees of Strength, as when the Capſula poſſeſs'd its healthful Contents.

But if we conſider, that in the ordinary Operation for the Removal of the Cataract, the *Ligamentum Ciliare* is always forcibly ſeparated from its Adheſions to the Capſula of the Chryſtalline, and by conſequence ſuch Uſes of it effectually deſtroy'd; we ſhall have very good reaſon to believe that the *Ligamentum Ciliare* has no ſuch Power, ſince we have many Inſtances of the Sight having been ſo reſtor'd by it, as to have enabled the Patient to ſee Objects at different Diſtances.

CHAP.

CHAP. XII.

Of the Reaſons of making my new Operation neceſſary to the Removal of the ſeveral Species of the true Cataract, as directed in the preceding Chapter.

I Paſs my Needle in a perpendicular Direction to the Globe of the Eye, with its convex Surface towards the ſuperior Part of the Orbit, that by the ſucceeding Motions of my Needle I may with the greater Certainty place its convex Surface under the Capſula of the Chryſtalline. I endeavour to place the convex Surface of my Needle about a Line below the inferior Surface of this Capſula, and about the ſame diſtance below the inferior Inſertions of the *Ligamentum Ciliare*, that I may afterwards with the greater Facility properly place its convex Surface under the inferior Surface of the Capſula of the Chryſtalline.—My Needle thus plac'd, I raiſe its convex Surface till it meets with a ſufficient Reſiſtance from the Chryſtalline to move

be and d that my Needle is plac'd immediately under the Chryſtalline, but learn with great Exactneſs under what Part of the Capſula my Needle is thus plac'd. I endeavour by the ſucceeding Motions of my Needle, to place its convex Surface immediately under a certain Part of the Capſula of the Chryſtalline, that I may be the more exact in the Place proper to make the Opening into this Capſula. — The convex Part of my Needle being properly placed under the Capſula of the Chryſtalline, I raiſe the Chryſtalline about a third of a Line towards the ſuperior Part of the Orbit, and inſtantly withdraw my Needle about two Lines with its Surface in the ſame Direction, that by thus permitting the Chryſtalline to fall a certain diſtance below the Point of my Needle, I may with greater Certainty make an Opening of a proper Length in the inferior Part of its Capſula. — After having open'd the Capſula, I continue my Needle about two Lines towards the inferior Part of the Orbit, that by thus forcibly breaking into thoſe Parts of the *Vitreous* over which my Needle was plac'd, there may be a Place prepar'd for the more eaſy Reception of the diſeas'd Chryſtalline. I endeavour by the ſucceeding Motions ſo to place the plane Surface of my Needle on the ſuperior and

lateral

Surface of the Capſula of the diſeas'd Chry-
ſtalline may maintain the ſame Diſtance and
Direction from all the inner Surface of the
Uvea. I endeavour by the ſucceeding Mo-
ions of my Needle to replace its plane Sur-
ace about a Line farther, towards the poſte-
ior Part of the Capſula of the Chryſtalline,
r about a Line farther from the ſuperior
nſertions of the *Ligamentum Ciliare*, that I
nay not be expos'd in paſſing the Chryſtal-
ine thro' the Opening I made in its Capſula,
o break any of thoſe Parts of the Capſula on
which my Needle is plac'd, or ſeparate this
Capſula from any of its Adheſions with
e *Ligamentum Ciliare*; which might have
appen'd, had I endeavour'd to force the
hryſtalline thro' the Opening in its Capſu-
, when the plain Surface of my Needle
as in its preceding Situation: And to the
ore effectually anſwering this Intention,
continue my Needle in this oblique Dire-
ion of its plane Surface on the ſuperior and
ſterior Part of the Capſula of the Chry-
alline, till I perceive it on its Paſſage on
e Capſula about the Center of the Axis of
e Eye, and then I raiſe the anterior Edge of
y Needle towards the ſuperior Part of the
rbit; and in this Direction paſs it behind
e inferior Surface of the *Uvea.*

The

inner Surface of the Orbit, I turn this plane Surface of my Needle with great Quickneſs towards the inferior Part of the Globe, and endeavour by all the ſucceeding Motions ſo to place the Chryſtalline, as it may maintain its Seat out of the Axis of the Eye. I continue the plane Surface of my Needle for ſome little time plac'd on the preſent anterior Surface of the alter'd Chryſtalline, to give time for the Parts of the new convex *Vitreous* to poſſeſs their new Seat with the greater Exactneſs, and thus render the alter'd Chryſtalline leſs liable to change from the Situation in which I have plac'd it. I then raiſe the anterior Edge of my Needle, till its convex Surface is immediately directed towards the ſuperior Part of the Orbit, and draw my Needle out of the Eye in the ſame Direction, that I may not be expos'd to change any of the preſent Situation of the Contents of the Globe in its Paſſage.

CHAP

CHAP. XIII.

Of the Manner of making my new Operation, neceſſary to the Removal of the ſeveral Species of that Cataract which ariſes from a Blow receiv'd near the Eye; where the alter'd Chryſtalline is paſs'd thro' the anterior Part of its Capſula, and being continually changing its Situation behind the Uvea, *is known by the Name of the* ſhaking Cataract.

I Proceed exactly as in the Operation for the ſeveral Species of the true Cataract, till my Needle is paſs'd about two Lines into the *Vitreous*; I then withdraw my Needle in the ſame Direction, till I judge its Point about one Line from its Entrance into the Globe; I then gently raiſe the poſterior Edge of my Needle, and very ſlowly direct my Hand backwards, till I judge that its

within the Axis of the Eye. I then continue to direct my Hand backwards, till I judge that the convex Surface of my Needle is obliquely ſituated from its Point to the inner and outward Surface of the *Uvea*. I then continue my Needle forward with its Surfaces in the ſame Direction, till I perceive its Point immediately before the preſent anterior Surface of the diſeas'd Chryſtalline; I inſtantly direct the ſuperior Edge of my Needle towards the ſuperior Part of the Globe, till its plain Surface is plac'd on or near the ſuperior and lateral Surface of the alter'd Chryſtalline; I gently depreſs the Chryſtalline about a third or fourth Part of a Line, to learn with ſome Exactneſs on what Part of the Chryſtalline my Needle is plac'd; and if on inſpecting the Pupil, I perceive that the anterior Surface of the Chryſtalline is not continu'd in a direct Line at the ſame diſtance from the inner Surface of the *Uvea*, but approaches nearer to, or recedes farther from it, I then replace the plane Surface of my Needle nearer to, or farther from the Surface of the *Uvea*, according to of the Direction I receiv'd from the Motion the alter'd Chryſtalline; and when I find by the Motions of the alter'd Chryſtalline, that

vould be continu'd in a direct Line, at the ame distance from all the inner Surface of the *Uvea*. I continue my Needle with its Surfaces n the same Direction thro' the Axis of the ye, and thus forcibly remove the alter'd hrystalline into those Parts of the *Vitreous*, ver which it was immediately plac'd. My eedle thus plac'd on the present superior rface of the alter'd Chrystalline, I instant- direct its anterior Edge towards the infe- or Part of the inner Surface of the *Uvea*, d finish the Operation as in that for the moval of the several Species of the true taract.

CHAP. XIV.

f the Reasons of making my new Ope- ration necessary to the Removal of the several Species of the Cataract known by the Name of the shaking Cataract, *as directed in the prece- ding Chapter.*

MY Needle having pass'd about two Lines into the *Vitreous*, I withdraw the same Direction, till I judge its Point

about

rior Edge of my Needle, and very slowly direct my Hand backward, till I judge that its convex Part is brought parallel to the inner Surface of the *Uvea*, that on directing its Point into the Axis of the Eye, I may not be expos'd to wound any of the Parts of the *Ligamentum Ciliare*. I endeavour by the succeeding Motions of my Needle so to place its plane Surface on the superior and lateral Surface of the alter'd Chrystalline, that on directing my Needle towards the inferior Part of the Orbit, the anterior Surface of the alter'd Chrystalline may continue at the same Distance and Direction from the inner Surface of the *Uvea*. My Needle thus placed, I forcibly remove the alter'd Chrystalline, and finish the Operation as in the true Cataract, for the Reasons given in that Chapter.

CHAP

CHAP. XV.

Of the Manner of making my new Operation neceſſary to the Removal of the ſeveral Species of the falſe Cataract.

I Proceed exactly as in the Operation for the ſeveral Species of the true Cataract, ıil I find by the Motion of the alter'd Chryſtalline that the plane Surface of my Needle is ſo exactly plac'd on the ſuperior nd lateral Surface of the Capſula of the al-er'd Chryſtalline, that on continuing it to-vards the inferior Part of the Orbit, the an-erior Surface of the Capſula of the alter'd Chryſtalline might be placed in a direct ine at the ſame diſtance from the inner urface of the *Uvea.* I again depreſs the al-er'd Chryſtalline about half a Line towards ıe inferior Part of the Globe; and by this Iotion of my Needle I enlarge the Open-g I made in the inferior Part of its Capſu-, and leſſen the Plenitude of its Contents. then once more raiſe my Needle towards le ſuperior Part of the Globe, with its Sur-

the ſuperior Part of the Capſula of the Chryſtalline. I then replace the plane Surface of my Needle about a Line farther, towards the poſterior Part of the Capſula of the Chryſtalline, or about a Line farther from the ſuperior Inſertions of the *Ligamentum Ciliare*. My Needle thus plac'd, I continue it very ſlowly, directing its plane Surface immediately towards the Opening I made in this Capſula, and thus forcibly remove the alter'd Chryſtalline into thoſe Parts of the *Vitreous* thro' which I paſs'd my Needle, after having broke thro' the inferior Parts of the Chryſtalline and its Capſula.

And as the Contents of the Chryſtalline are thus paſs'd thro' the Opening in this Capſula, I continue the plane Surface of my Needle on the ſuperior and lateral Surface of the Capſula of the Chryſtalline, till I judge it in its Paſſage on the Capſula about the Center of the Axis of the Eye, when inſtantly I raiſe the anterior Edge of my Needle towards the ſuperior Part of the Orbit; and in this Direction paſs it with great Exactneſs behind the inferior Surface of the *Uvea*. My Needle thus plac'd, I turn with great Quickneſs its plane Surface towards the inferior Part of the Orbit; thus it neceſſarily falls on ſome

hen direct the plane Surface of my Needle obliquely towards the posterior Part of the Globe, and forcibly continue it about a Line below a Line drawn parallel to the Center of the Globe, and thus mix the Contents of the alter'd Chrystalline with some of the inferior Parts of the Vitreous.

By thus passing the diseas'd Chrystalline thro' the Opening I made in its Capsula, the superior Part of this Capsula being suspended by its Adhesions to the *Ligamentum ciliare*, the alter'd Chrystalline passes with great Facility from under its Capsula, not only from the Assistance it receives by the Needle, but from that of the Vitreous, which at this time necessarily comes forward with some degree of Force, to make room for the reception of the alter'd Chrystalline.

And from this slow and regular Passage of the alter'd Chrystalline out of the Axis of the Eye, the concave Vitreous must necessarily change its Situation, and rise with great Exactness immediately behind the superior and posterior Surface of this Capsula, and become convex; and as the superior and posterior Part of this Capsula is thus forced on the inner Surface of the anterior, the whole Capsula of the alter'd Chrystalline is immediately seated before the Membrane of the now convex Vitreous; and it is thus the Figure of the convex Vitreous is nearly, if

ful Chryſtalline.

After having thus remov'd from the Axis of the Eye the Contents of the alter'd Chryſtalline, I proceed to remove this opake Capſula from before the Membrane of the now convex Vitreous; and for this End I withdraw my Needle, till I judge its Point about one Line from its Entrance into the Globe; and after having gently rais'd the poſterior Edge of my Needle, I very ſlowly direct my Hand backwards, till I judge that its convex Surface is brought parallel to the inner Surface of the *Uvea*. I then continue my Needle forward with its Surface in the ſame Direction, till I judge its Point to be enter'd within the Axis of the Eye. I then continue to direct my Hand backwards, till I judge that the convex Surface of my Needle is obliquely ſituated from its Point to the inner and outward Surface of the *Uvea*. I then continue my Needle forward with its Surface in the ſame Direction, till I perceive its Point enter'd into the poſterior Chamber of the Aqueous, immediately before the anterior Surface of the opake Capſula. I then leſſen the Preſſure of my *Speculum*, and continue my Needle thro' the poſterior Chamber of the Aqueous, with its Surfaces in the ſame Direction, till its Point is carried about half a Line under the inferior and lateral Edge of the Pupil, when the Pupil is neither contracted

ſula over which the inferior Edge of my Needle is plac'd, and thus ſeparate with great Exactneſs all the inferior and lateral Extremities of the *Ligamentum Ciliare* towards the greater *Canthus*, from their Adheſion to this opake Capſula. I then continue the plane Surface of my Needle towards the Center of the opake Capſula, and direct its Point forward till arriv'd about the ſame diſtance under the ſuperior and lateral Edge of the Pupil, as it was in the preceding Motion of my Needle under the inferior; and by gently preſſing with the ſuperior Edge of my Needle, I ſeparate in like manner all the ſuperior and lateral Extremities of the *Ligamentum Ciliare* towards the greater *Canthus*, from their Adheſion to this opake Capſula. I then withdraw my Needle till its Point is brought from behind the Pupil, and continue to raiſe the ſuperior Edge of it towards the ſuperior Part of the Orbit, and thus paſs its plane Surface immediately before the anterior Part of this opake Capſula, till its Point is arriv'd about the ſame diſtance under the Center of the ſuperior Edge of the Pupil, as it was in the preceding Motion under the ſuperior and lateral; and by gently preſſing with the ſuperior Edge of my Needle, I in like manner

opake Capſula.

The Opake Capſula of the Chryſtalline being thus ſeparated on all Sides from its Adheſions to the *Ligamentum Ciliare*; and the plane Surface of my Needle, now placed on the ſuperior and lateral Part of the anterior Surface of this opake Capſula, I very gently preſs with the ſuperior Edge of my Needle on this Capſula; and by continuing its Surfaces in the ſame Direction towards the inferior and inner Surface of the *Uvea*, the opake Capſula paſſes with great Exactneſs from before the Surface of the now Convex Vitreous. — My Needle with the opake Capſula of the Chryſtalline being now out of the Axis of the Eye, and ſeated immediately behind the inferior and inner Surface of the *Uvea*, I continue it, with its Surfaces in the ſame Direction, to about a Line below a Line drawn parallel to the Center of the Globe, and thus place this opake Capſula near the inferior and lower Part of the Vitreous; I then inſtantly raiſe the anterior Edge of my Needle, 'till its Convex Surface is immediately directed towards the ſuperior Part of the Orbit, and very ſlowly take it out of the Eye, in the ſame Direction.

CHAP.

CHAP. XVI.

Of the Reasons of making my new Operation necessary to the Removal of the several Species of the false Cataract, as directed in the preceding Chapter.

I Proceed exactly, as in the Operation for the several Species of the true Cataract, 'till the plane Surface of my Needle is properly placed on the superior and lateral Surface of the Capsula of the alter'd Chrystalline; that by the succeeding Motions of my Needle in pushing the Chrystalline towards the inferior Part of the Globe, the anterior Surface of its Capsula may maintain the same Distance and Direction from the inner Surface of the *Uvea*. I then endeavour to replace the plane Surface of my Needle, about a Line farther towards the posterior Part of the Capsula of the alter'd Chrystalline, or about a Line farther from the superior Insertions of the *Ligamentum Ciliare*, that

Parts of the Capſula, on which my Needle is placed, or ſeparate this Capſula from any of its Adheſions with the *Ligamentum Ciliare*; which might have happen'd, had I endeavour'd to force the alter'd Chryſtalline through the Opening in its Capſula, when the plane Surface of my Needle was in its preceding Situation. — The alter'd Chryſtalline being paſs'd through the Opening I made in its Capſula, I endeavour, by all the ſucceeding Motions of my Needle, to mix its Contents with thoſe of that Part of the Vitreous, which is ſeated out of the Axis of the Eye; that notwithſtanding its Fluidity, no Part of it ſhall be able to enter the poſterior Chamber of the Aqueous, during the Progreſs of the Operation, neceſſary to the Removal of the Capſula from before the Surface of the now Convex Vitreous.

Having thus placed the Contents of the Chryſtalline, I withdraw my Needle, with its Surfaces in the ſame Direction, 'till I judge its Point about one Line from its Entrance with the Globe, for the Service intended by the ſucceeding Motion. I gently raiſe the poſterior Edge of my Needle, and very ſlowly direct my Hand backward, 'till I judge that its Convex Surface is brought

Axis of the Eye, I may not be exposed to wound any of the Parts of the *Ligamentum Ciliare.* My Needle being enter'd into the posterior Chamber of the Aqueous, I lessen the Pressure of my Speculum, that by the present Loss of the Plenitude of the Globe, from having open'd the aqueous Chambers, I may so considerably enlarge its Diameter, and lessen its Convexity, as to be able to pass with the greatest Facility the plane Surface of my Needle immediately before all the Surface of the opake Capsula, without being expos'd to alter in its Passage the present Position of any of the Parts of the Capsula or Vitreous. — I intend, by all the succeeding Motions of my Needle, to remove with great Exactness the opake Capsula, without wounding, or violently breaking any of the Parts of the *Ligamentum Ciliare*, and effectually place it out of the Axis of the Eye.

CHAP.

CHAP. XVII.

Of the Manner of making my new Operation neceſſary to the Removal of the ſeveral Species of that State of the Glaucoma, *where the* Iris *and immediate Organ of Sight maintain their healthful Perfection.*

I Proceed exactly, as in the Operation for that Alteration of the Chryſtalline, call'd the *Shaking Cataract*, 'till I perceive the Point of my Needle within the poſterior Chamber of the Aqueous. I then ſeparate the Capſula of the Chryſtalline from its Adheſions to the *Ligamentum Ciliare*, exactly after the ſame Manner as I have directed in that Part of the Operation for the ſeveral Species of the falſe Cataract, where I remove the opake Capſula from before the Convex Vitreous. — The Capſula of the Chryſtalline being now ſeparated on all Sides from its Adheſions to the *Liga-*

line about a third or fourth Part of a Line, to learn with ſome Exactneſs, on what Part of the Capſula of the Chryſtalline my Needle is placed: And if on inſpecting the Pupil, I perceive that the anterior Surface of the Capſula of the Chryſtalline is not continued in a direct Line, at the ſame Diſtance from the inner Surface of the *Uvea*, but approaches nearer to, or recedes farther from it; I then replace the plane Surface of my Needle nearer or farther from the inner Surface of the *Uvea*, according to the Direction I received from the Motion of by the alter'd Chryſtalline; and when I find by the Motion of the alter'd Chryſtalline, that the plane Surface of my Needle is ſo exactly placed, that on continuing it towards the inferior Part of the Orbit, the interior Surface of the Capſula of the alter'd Chryſtalline would be continued in a direct Line, at the ſame Diſtance from the inner Surface of the *Uvea*; I continue to move my Needle very ſlowly through the Axis of the Eye, 'till its Convex Surface is placed immediately behind the inferior and inner Surface of the *Uvea*, and thus forcibly remove the Chryſtalline with the Capſula, into the Vitreous.

By

Vitreous must necessarily come forward, to give Place for the Reception of the alter'd Chryſtalline; and become Convex.

My Needle thus placed with its plane Surface on the preſent ſuperior Surface of the Capſula of the alter'd Chryſtalline, I instantly direct its anterior Edge towards the inferior Part of the inner Surface of the *Uvea*; and by thus changing the Direction of my Needle, its plane Surface is brought about the ſame Diſtance towards the preſent anterior Surface of the Capſula of the alter'd Chryſtalline.

The plane Surface of my Needle being now obliquely ſituated towards the poſterior Part of the Globe, I continue my Needle in the ſame Direction, about a Line below a Line drawn parallel to its Center, and thus place the Chryſtalline near the inferior and lower Parts of the Vitreous. — I then continue my Needle about two Minutes thus plac'd on the preſent anterior Surface of the diſeaſed Chryſtalline: And after raiſing its poſterior Edge till its convex Surface is immediately directed towards the ſuperior Part of the Orbit, I very ſlowly take it out of the Eye in the ſame Direction.

CHAP.

CHAP. XVIII.

Of the Reasons of making my new Operation necessary to the Removal of the several Species of that State of the Glaucoma, *where the* Iris *and immediate Organ of Sight maintain their healthful Perfection.*

I Proceed exactly as in the Operation for that Alteration of the Chrystalline, call'd the *Shaking Cataract*, 'till I perceive the Point of my Needle within the posterior Chamber of the aqueous Humour; that I may with the greater Certainty enter this Chamber, without being expos'd to wound any of the Parts of the *Ligamentum Ciliare*. I intend by the succeeding Motions of my Needle to separate with great Exactness the *Ligamentum Ciliare* from all its Adhesions to the Capsula of the Chrystalline, without wounding or violently breaking any of its Parts. I endeavour by the succeeding Motions of my Needle so to place its plane

Part of the Orbit, the anterior Surface of the Capſula of the alter'd Chryſtalline may continue at the ſame Diſtance and Direction from all the inner Surface of the *Uvea*.

The Chryſtalline with its Capſula being plac'd out of the Axis of the Eye; with the plane Surface of my Needle on the preſent ſuperior Surface of the Capſula of the alter'd Chryſtalline, I endeavour by all the ſucceeding Motions ſo to place the alter'd Chryſtalline, as it may maintain its Seat out of the Axis of the Eye.

CHAP.

CHAP. XIX.

f the Regimen neceſſary to ſucceed my new Operations for the ſeveral Species of the true Cataract, and the ſeveral Species of the Cataract call'd the ſhaking Cataract. *For the ſeveral Species of the falſe Cataract, and the ſeveral Species of that State of the* Glaucoma, *where the* Iris *and immediate Organ of Sight maintain their healthful Perfection.*

AFTER the Operation I cauſe ſome Drops of a Mixture (made of a Tin-re of *Balſ. Peruv.* with warm Water) to drop into the Eye for ſome Minutes; and mediately after I cauſe to be apply'd over the elids a warm Cataplaſm, made with ſome ops of the above-mention'd Mixture, and Pulp of *Caſſia.* Theſe Drops and Cata-ſm are to be repeated every four Hours cept at the time of Sleep) till the ſecond

Hour, in the usual manner, with a spiritu-
ous Fomentation with Camphire. I the
give free Power to the Motion of th
Eyelids, and cause a Shade to be so fix'
before the Eye, as to admit of its receivin
very little Light, and entirely to prevent th
Light from falling immediately within th
Axis of the Eye. I cause this Fomentatio
to be repeated twice a Day for about fif
teen Days, and the Shade to be continu'd i
different Directions before the Axis of th
Eye, till the Eye can perceive Objects in th
ordinary Degrees of Light without Pain.

The Patient is to be continu'd for abou
twenty Days in the medicinal attenuatin
Diet, accompany'd with gentle Evacuation
as mention'd necessary to precede these Ope
rations.

F I N I S.

ADVERTISEMENT.

IN about two Months the Author of this Work will publiſh a new Treatiſe on the Anatomy, Supplies, and Uſes of the ſeveral Parts of the Globe of a human Eye, with its Glands, Coverings, and lachrymal Canals.

To which will be added ſome Obſervations on that important Queſtion, *viz.* Whether the *Choroides* or *Retina* is the immediate Organ of Sight?

This Work will be follow'd with all poſſible Expedition, by new Treatiſes on the Diſeaſes of the immediate Organ of Sight, *Cornea*, *Uvea*, lachrymal Canals, and Eyelids.

MECHANISM
OF THE
EYE.

Wherein its Power of Refracting the Rays of LIGHT, and Causing them to Converge at the *RETINA*, is Consider'd: With an Endeavour to ascertain the true Place of a CATARACT, and to shew the good or ill Consequences of a Judicious or Injudicious REMOVAL of it.

By **John Taylor**, Surgeon in *Norwich*.

Hear him ye Deaf, and all ye Blind behold!
He from thick Films shall purge the Visual Ray;
And on the sightless Eye-Ball pour the Day:

NORWICH:
Printed by *Henry Cross-grove*, and Sold by the Booksellers of *London* and *Norwich*, 1727.

165048

TO

Mr. WILLIAM CHESELDEN,

Surgeon to St. *Thomas*'s Hoſpital,

AND

FELLOW of the ROYAL SOCIETY.

SIR,

I Have heard, that the Watch-Word in the Time of War, is frequently the Name of One of the Generals; and that he who

ing Demanded, *Who Goes there?*) is allow'd, without further Queſtions, to paſs on about his Buſineſs.

This engag'd me to ask the Liberty of Prefixing your Name to this Trifle; which however unworthy it may be of the Honour, will yet derive a double Advantage from it; firſt to Itſelf, then to it's Author: It will Itſelf, by this Means, paſs unqueſtion'd into the World; and it's Author will have an Opportunity of paying due Acknowledgments, for the

Benefits

Benefits he has receiv'd from your Induſtry and Ingenuity. The Succeſs which has ſo frequently attended the Uſe of your Needle in this Delicate Operation, ſufficiently ſhews the Niceneſs of your Hand; and the little Damage you have ever done, where Unavoidable Accidents have conſpir'd to render the Operation unſucceſſul, is a great Evidence of he Accuracy of your Judgnent.

The Knowledge I have of his Branch of my Profeſſin, ſuch as it is, I am wholy

the Success I have had on a Great Number of Subjects within these two Years, will I hope prove that I have follow'd no ill Director.

If I have in any Degree made it probable, that the Opacity of the Crystalline Humor is the True CATARACT, I must here own that I had the First Hint of it from You: And if I have done no Injustice to your Opinion by unworthily defending it, I hope shortly to see some One of my Brethren, more able than Myself,

for the Diſcovery.

I am,

Worthy SIR,

Your moſt Obliged

and moſt Obedient

Humble Servant,

JOHN TAYLOR.

THE

PREFACE.

I Think it Neceſſary for my own Vindication to ſay Something by Way of Preface, and I expect to be pardon'd for it by all Honeſt Impartial Men; for 'tis to ſuch only I appeal, having already ſuffer'd as much as I could ſuffer, from Men of a Character quite contrary.

I am ſorry I have it to ſay, That the worſt Uſage I have met with, has been

mine whilſt an *Embryo*, has been ſufficiently ridicul'd by them: 'Tis, perhaps, ſtill ſhapeleſs and unform'd; but if there are found in it the Features of a Man, 'twill at leaſt demand ſome Regard from all thoſe who would deſerve the Character of Men. I have been driven to ſuch a *Dilemma* by their Unnatural Treatment, that for ſome Time I have ſuſpended the Publication, and was once reſolv'd intirely to ſuppreſs it. This following has been their Way of Arguing, *If 'tis his Own, 'twill not bear the Light; if 'twill bear the Light, 'tis not his Own*; either Side of this would be equally prejudicial to me: But I ſhall endeavour to prove, that if I have not made a very ill Uſe of

my

When I have done this in the beſt Manner I am capable, I ſhall deſire this following Fair Challenge may be annex'd to my Account of Myſelf: That if any of my *Unkind Brethren* have any Thing to ſay, which They think will prove me too ignorant for my Profeſſion, that they may do it in the ſame publick Manner which I have made Uſe of to prove that I am not ſo.

The Worthy Gentleman to whom I have made an Offer of this Trifle in the *Dedication*, will be my Witneſs of rhe Truth of the following Particulars: That I attended the Practice of St. *Thomas*'s Hoſpital regularly

niſh'd at that Time with a Sett of the Beſt and moſt Rational Practitioners which have been ever known there.

I think according to the Account of the Hoſpital, that there are very ſeldom leſs than 4 or 5000 Subjects cured of their ſeveral Diſeaſes in a Year; and I believe it will very readily be granted by all unprejudic'd People, that where Accidents are ſo various and numerous, a young Surgeon may improve himſelf more in five or ſix Months, than he can with the beſt private Maſter in the Kingdom in as many Years: Here moreover a Man has the Opportunity of learning every Branch of his Profeſſion; and he who does not endea-

vour

to be ſuſpected of great Negligence in his Obſervation, or Want of Ability to ſee into the Reaſon of the Practice; either of which will certainly make him fearful of undertaking it, becauſe the Succeſs will always appear doubtful to him: But when a Man has by diligent Obſervation on the Chirurgical Part, and a competent Knowledge of the Rational, qualify'd himſelf to diſcharge the Duty of his Profeſſion with Ability and Honeſty, I think his endeavouring to do ſo, ſhould not only not render him obnoxious to the Gentlemen of his Profeſſion, but even make him claim ſome Share of their Regard, and Protection too from the Inſults of the reſt of the World:

But

When I came to practiſe in this City, full of Expectation of the Uſage juſt now mention'd, I ſoon found myſelf miſerably deceiv'd; for inſtead of That, I was immediately ſurrounded with *Calumny* and *Detraction*: And from what Quarter? Why even from thoſe Gentlemen by whom I thought to be *Protected*: There was immediately a *Party* raiſed againſt me, who not contented with aſperſing my Abilities, fell foul upon my Manners; and would fain have inſinuated, (if they could have got any Man of Senſe to have believ'd them) that if a Man wore tolerable good Cloaths, and lik'd the Company of a Friend, 'twas impoſ-

ſible

who are themſelves

------ Dully grave, inſipidly ſerene,
And carry all their Wiſdom in their Mien.

And in ſhort, they like Nobody, but ſuch as are like themſelves: So that an Awkard *Saint-like* Behaviour, a *Solemn* Gait, an *Hypocritial* Elevation of the Eye, and an *Affected Religious* Grimace, is ſufficient with them to ſet a Man at the Head of his Profeſſion. If a Man is recommended to any of them, the Firſt Queſtion is, *Is he One of Us?* If they are anſwer'd in the Negative, they immediately fly; and tho' they know Nothing of the Man, ſwear he has no Faith, no Honour, no Capacity,

ly'd to be employ'd in any Thing.

'Tis a great Hardſhip to fall into the Hands of theſe Gentlemen, and yet to be quite void of all thoſe valuable Talents which muſt recommend one to their Favour. For my Part, if I am call'd to a Patient, I expect my Buſineſs is with his *Body*, and not with his *Soul*: I can *Set* a Broken Leg, as well as my Neighbours; but as to *Caſes of Conſcience*, I muſt leave them to be ſet right by Gentlemen whoſe Profeſſion qualifies and authorizes them to do it.

But I am afraid, if we come to examin the Matter a little more cloſely, we ſhall find that this is generally all

n odd Way of imposing upon the
Vorld, and giving of it one Term for
nother: Their pretended *Gravity*
hould be call'd N*atural Dulness*, for
is so in Fact; and where there is
ire, it will shew itself: Their Pre-
ence to *Religion*, in Opposition to
Human Reason, is not because they
ave *more* of the First than their
Neighbours, but *less* of the Latter:
heir *Canting* Custom of Asking a
eculiar Blessing on every Thing
ney undertake, is because they know
heir Skill will stand very much in
Need of it: Their Disaffection to
Human Learning is, because they
now Nothing more of it than the
Name; and so of every Thing else:

ty People to trust Mens Lives and Limbs with.

I have often wonder'd, that when the ACT was made for Examining all Surgeons (before they were admitted to practiſe in and about *London)* at *Surgeons-Hall*, the ſame Order did not paſs thro' every County, that the Country might have had the ſame Advantage of having a Sett of Able Men amongſt them as the Town has: Many and great would have been the Benefits of it, to the Profeſſion in General, to every Able Profeſſor of it in Particular, and to all thoſe whoſe Misfortunes oblige them to have Recourſe to It or Them for Aſſiſtance.

ing d to be diligently attentive in
is Bufinefs, in order to qualifie him-
elf to pafs his Examination; and
his certainly in Time would be of
nfinite Advantage to the Profeffion:
very Able Profeffor of it would
ertainly be known, by that very
xamination, to be fo; and by this
Ieans would be plac'd in his pro-
er Sphere, and fear no Danger from
ne *Canting Blockheads* beneath him.
'he Benefit of the Patient, is too ob-
ious to be infifted upon; his Limbs
ery frequently, and often his Life
oo would be preferv'd by it.

But as a *Capacity* is not Every Thing
hich is requir'd of a Surgeon, I wifh
ere was any Method as certain as

others who have had the Firſt and wanted the Latter; but in order to make a Good Surgeon, 'tis abſolutely neceſſary that a Man ſhould want Neither of them. I'll beg the Liberty to relate a Story or Two of a Gentleman who has been remarkably kind to me, and I am very glad I have this Opportunity of returning his Civility, and letting the World know that he is a Man of *Real Merit*: This Friend of mine was ſent for to a Child that had diſlocated its Knee, he carried with him Plaiſters, Bandage, *&c.* in order to reduce it, which he endeavour'd to do in the beſt Manner his Capacity would admit of; after the Buſineſs was over, he

he call'd to ſee his little Patient, and found the Family much pleas'd at his *great* Skill, declaring that the Child's Complaint in that Part was intirely remov'd: The Doctor finding in this Caſe that he had not ſpent his Skill in vain, began to exert himſelf upon it, and undertook a Caſe of much more Difficulty, (which prov'd a *Diſlocation* in Fact) in which he aſſured them of the like Succeſs, and that he would cure that as expeditiouſly as he did the other; which, to prove his Aſſertions true, he actually did; by which *wonderful* Cure he has demonſtrated his *Genius* in a *laudable* Manner. Another Brother of mine (ſome ſmall Diſtance from this Place) had the Care of a Gentlewoman, whom

than he found her; ſhe applied herſelf to a Surgeon of my Acquaintance, who made a perfect Cure of her in Fourteen Days: This *Wonderful* Man was ask'd ſome Time after, How it came about that a Man of his *pretended* Abilities and long Practice, after a Trial of Years, ſhould miſs of Succeſs in a Caſe where a Young Fellow juſt beginning to practiſe, ſucceeded to the Surprize of the whole Town in a few Days? And whether he did not think it ought to diminiſh his Character, and add to the Character of the other? He had a Conflict with himſelf for ſome Time whether he ſhould ſacrifice his *Capacity* or *Honeſty*; at laſt it went on the Side of *Dear Capacity*,

him, and haſten to tell you the Reaſon of my publiſhing the following Account of a CATARACT.

I am more ſenſible than any other Man can be, of my own Inability to perform accurately what I have propos'd in my *Title-Page*; my Deſign not being at all to inſtruct thoſe whoſe regular Education in Phyſick and Mathematicks have qualify'd them to underſtand theſe Things infinitely better than I can pretend to do: And I declare before I enter upon the Work, that I have no other View in it than to ſatisfie the World that I am no *Empirick* (as I have been vilely and maliciouſly repreſented to

the Nature and Structure of the EYE, as is requir'd of any one who pretends to the Operation.

The Reason why this nice and necessary Operation is so rarely performed by Gentlemen regularly bred to the Profession of Surgery, I take to be this; That it having been a long Time the distinguishing Excellency of several of our famous Mountebanks, the regular Surgeons, by undertaking it, are under the dreadful Apprehensions of being rank'd with itinerant Operators, commonly known by the Name of *Quacks*: The Fault is absolutely their own; for did they not join with these *Empiricks* (whom upon

Fellow who dares attempt a Thing which is not the general Profeſſion of the whole Fraternity, whatever Pains he has taken, or whatever Advantages he has had to make himſelf Maſter of the Performance; did they not join to do this, I ſay, how ineffectual would all the little Malice and Calumny of theſe contemptible *Wretches* be towards ruining the Reputation of a regular Surgeon! And how eaſie would it be for us, (for 'tis We only who can do it) by making a Collection of the injudicious and barbarous Practices of thoſe illiterate murdering *Raſcals*, ſo to deſtroy their Reputations, (if 'tis not a Scandal to the Word *Reputation* to uſe

it

and ſome other Branches of our Profeſſion Home to ourſelves, the Original Proprietors, without any Manner of Danger of the foregoing Imputation.

A N

AN

ACCOUNT

OF THE

Mechaniſm of the EYE.

AS I have propos'd to give ſome Account of the Mechaniſm of the EYE, I know no properer Way of beginning it, than by an Anatomical Diſſection of the EYE Itſelf; and after I have ſhewn ſome few general Diſeaſes that the particular Coats and Humors of the Eye are ſubject to, I ſhall proceed to ſhew how the ſaid Coats and Humors are inſtrumental to

Viſion,

Place of a **Cataract**, and the Consequence of a *judicious* or *injudicious* Removal of It.

The Globe of the Eye is moved by Six Muscles, Four Streight, and Two Oblique, *viz. Elevator*, *Depressor*, *Adductor*, *Abductor*, *Obliquus Superior*, and *Inferior*: The First of these arises out of the Bottom of the *Orbit*, and after it has ascended and grown tendinous, is inserted into the Upper Part of the *Tunica Sclerotis*, near the *Cornea*. The *Depressor* arises and is inserted directly opposite to the *Elevator*. The *Adductor* arises from the Bottom of the *Orbit*, and is inserted on the Side next the Nose, into the *Tunica Sclerotis*. The *Abductor* arises and is inserted directly opposite to the *Adductor*. The *Superior* Oblique Muscle arises between the *Elevator* and *Adductor*, at the Bottom of the *Orbit*, thence ascending by the *Sutura Transversalis* becomes a Round Tendon, which passes thro' a little Annular Cartilage call'd *Trochlea*, (from its bearing the Form of a Pully) at the upper and inner Part of the *Orbit*,

cle arises from the Os *Maxilla Superioris*; thence passing over the *Depressor*, is inserted at the Bottom of the Eye near the *Abductor*. The Four Streight Muscles are so fix'd to the *Sclerotis*, that they lift up the Eye, depress it, bring it towards the Nose or from it, hold it fast, turn it round, just as they act either separately or conjointly.

The *Superior* Oblique Muscle moves the Eye round towards the Nose about its *Axis*, and pulls it upward and inward, and thereby directs the Pupil outward and downward; and thus the Eye is dispos'd to see Things placed near it. The *Inferior* Oblique Muscle turns the Eye towards the outward Corner, and also upwards; if these Two act together, they fix the Eye fierce and protuberant out of the *Orbit*: Moreover, another Use of these Muscles is, to suspend the Eye, and render it very fit to perform the Motions of the other Four. Between these Muscles Fat is interspers'd, which serves to lubricate and facilitate their Motion.

next

call'd the White of the Eye, and is full of Blood-Veſſels; which are very viſible in an *Ophthalmia:* The Symptoms of this Diſeaſe are Heat, Pain, Pulſation, and an apparent Diſtention of theſe Blood-Veſſels; it may be occaſion'd externally, by any Thing forc'd againſt or coming into the Eye, irritating or compreſſing the Fibres of this Coat. If this Inflammation be only external, the Caſe ſymptomatical, and the Patient not worne out by other Diſeaſes, 'tis eaſily Curable: On the Contrary, if it becomes ſo great as to tumefie the Face, and the Humors very pungent and corroſive, we judge it difficult to cure. Its Cure depends on Bleeding, lenient Purgation, Bliſtring, Cupping, *&c.* together with the Aſſiſtance of a cooling Diet, topical Application, and proper *Collyria.*

The next Coat is the *Sclerotis:* It expandes itſelf nearly into a Globe, membranous and hard almoſt like Leather, and encompaſſes the whole Eye, growing gradually thinner, clearer, and prominent in the Fore-part, which

Humors. This Coat is ſometimes diſeas'd by a little White Speck of a Cartilaginous Subſtance, covering Part of, and ſometimes the whole *Pupilla:* If this Excreſcence is only ſuperficial, it may be remov'd by an Operation in Surgery call'd **Leucotomy**; but if the *Cornea* is throly affected, I believe it incurable. This Operation is perform'd in the following Manner, *viz.* I place the Patient in a proper Poſition, and fixing the *Speculum Oculi* invented for that Purpoſe in order to keep the Globe without Motion, pare off the Excreſcence with a ſmall curv'd Knife, leaving as few Inequalities as poſſible; and having prevented an Inflammation by proper Repellents, I blow a Powder into the Eye; which, aſſiſted by the Motion of the Eyelid, ſmooths off the Inequalities left by the Knife.

Next to this Coat lies the *Tunica Choroides:* 'Tis a Membrane of little Firmneſs, being much thinner than the former; 'tis ting'd by a dark Liquor ſeparated from the Blood-

Veſſels,

the Circumference of this Hole, and which lies upon the Side of the Cryſtalline Humor, is call'd *Uvea*, compos'd of circular and ſtreight Fibres; 'tis qualified by this Means to contract and dilate, as Light and Objects make different Impreſſions upon it. The Outſide of this laſt Membrane is call'd *Iris*, where appear different Colours: On the Inſide of it from its Circumference ariſe the *Proceſſus Ciliares*, made of ſhort Fibres like Lines drawn from the Circumference to the Center.

The laſt Coat is the *Retina*, ſo call'd from its Reſemblance to a Net; it covers the whole Fund of the Eye, and is nothing more than a fine Expanſion of the Medullary Fibres of the Optick Nerve, upon which the Rays of Light meeting in a Point, convey the Images of outward Objects to the Brain. The Diſeaſe of this Coat is call'd *Gutta Serena*; the Eye ſeems clear in Appearance, and there are no other Signs of Blindneſs except a preternatural Dilatation of the *Pupilla*.

Between these Coats are contain'd Three Humors, the *Aqueous*, the *Crystalline*, and the *Vitreous*: The First is call'd *Aqueous* because it resembles Water, being a thin transparent Fluid; it serves to extend the *Cornea* into an equal Convexity; besides, it serves moreover for the *Crystalline* Humor to move forward or backward in, as Occasion requires us to see Objects nearer or farther from us.

Next is the *Crystalline*: It's compounded of numberless spherical Segments, closely united and transparent; its Shape is a depreſt spheriod, it's inclos'd in a fine Membrane call'd *Aranea*, and is much thicker than either the *Aqueous* or *Vitreous*: Its Diseases and Uses I shall speak of in another Place.

The next is the *Vitreous*: It's very clear and tenacious, it lies behind the *Crystalline*, and fills the greatest Part of the Eye; it's lenticular on every Side, its Foreside concave for the *Crystalline* Humor to lodge in, and

This Humor is ſometimes ſo vitiated as to hinder or utterly deſtroy Sight, which Diſeaſe is often miſtook for a *Gutta Serena.*

I ſhall now proceed to ſpeak of the Parts of the Eye, as they are ſubſervient to Viſion.

The Uſe of the Muſcles in general is to direct the Globe of the Eye, and fix it in ſuch a Poſition, as that the Rays of Light reflected from any Object which we would have viſible to us, may paſs thro' the *Pupilla* and paint the Image of it on the *Retina.*

To form the Image of any Object, 'tis neceſſary that the Rays of Light coming from it ſhould converge and meet in a *Focus:* And we judge of the comparative Magnitude of all Bodies, by the Angle which is ſubtended by thoſe Bodies before the Eye.

To qualifie the Eye to perform this, Nature has given it a ſpherical Form, and compos'd it of tranſparent Coats and Humors; the latter to tranſmit the Rays coming from the

bring them all together in a Point on the *Retina*.

All convex diaphanous Bodies refract the Rays of Light by Attraction, and the Ray bends towards that Part of the Body where there is the greateſt Quantity of Matter; this in convex Bodies is the Middle.

Therefore all Rays on whatever Parts of ſuch Bodies they fall, are refracted towards a Line drawn thro' the Center of hoſe Bodies, and made to converge behind hem at a Diſtance proportionable to the greater or leſs Convexity of the Bodies themelves: Thus when the Eye is too flat, as n old People, (from a Decay of the Humors, r a Shrinking of the Coats, or both) the onverging Rays do not coaleſce at the *Reina*; but would paſs on if ſuffer'd, and not ome to a Point but at ſome Diſtance beyond : By this Means Viſion becomes weak nd indiſtinct.

gibbous, and the Convexity of them is ſo great, that the Rays meet and croſs one another before they arrive at the *Retina*. The former Eyes are help'd by Convex-Glaſſes, which put the Rays into a State of eaſie Refraction before they fall upon the Eye: The latter are help'd by Concave-Glaſſes, thro' which the Rays paſſing do diverge, and fall upon the Eye in ſuch a Manner, as to require a greater Degree of Refraction than they would in their natural Courſe: In the former Caſe the Eye is not help'd by the Object's appearing bigger, but more diſtinct; for very ſmall Objects are render'd diſtinctly viſible to ſuch an Eye by the Help of a Convex-Glaſs, whereas very large ones cannot be ſeen enough to be diſtinguiſh'd by the Naked Eye.

I don't propoſe to give any new Theory of Viſion, nor to be able to deſcribe the Manner of it better than 'tis already done by an eminent Author; for which Reaſon I ſhall make uſe of his own Words, ſo far as they are ſerviceable to my preſent Purpoſe, and conducive

a Cataract.

All the Rays which come from one Point of an Object, are by the *Cornea* and Humors of the Eye united in a Point of the *Retina*, which is in a ſtreight Line, drawn from the ſame Point of the Object, thro' the Center of the Eye; and conſequently all the Rays, which come from all the Points of an Object, are united on the *Retina*, in the ſame Order and Proportion as the Points of the Objects are from whence thoſe Rays come.

Therefore the Interpoſition which theſe Rays make upon the *Retina*, muſt be the Image of the Object.

And thus Viſion in general is perform'd: But to know what the ſeveral Parts of the Globe contribute hereunto, it's needful to obſerve that the *Cornea* is more convex than any other Part of it; by which Means all the Rays are gather'd to paſs thro' the *Pupilla*, and none of them are loſt upon the *Uvea*.

either the *Ligamentum Ciliare* contracts, or both the Oblique Muſcles ſqueeze the Middle of the Bulb of the Eye, to render it oblong, when Objects are too near us.

The ſtreight Fibres of the *Uvea* dilate the *Pupilla*, when there are but few Rays of Light; and the circular Fibres contract it, when there are too many.

When the *Pupilla* is contracted, we ſee moſt diſtinctly; when it is dilated, we ſee moſt clearly.

The *Glaſſy* Humor keeps the *Cryſtalline* at ſuch a Diſtance from the *Retina*, as is neceſſary for uniting the Rays, which come from one Point of the Object, exactly in one Point of the *Retina*. The Impreſſion of the Object is made upon the *Retina*.

The *Choroides* is tinctur'd black, that the Rays of Light which paſs thro' the *Retina* may not be reflected back again to confuſe the Image of the Object.

Being

of all the Rays which come from of an Object exactly in one Point of the *Retina*; and that the Rays which come from Objects at different Diſtances, are united at different Diſtances, behind the *Cryſtalline* Humor; they cannot both be exactly united upon the *Retina*, therefore the Eye cannot ſee equally diſtinct, at the ſame Time, Objects at different Diſtances.

The Optick Nerves pierce the Globe of the Eye, a little on the Inſide of the Optick *Axes*. Their external Coat, which is a Production of the *Dura Mater*, is continu'd to the *Sclerotis*, as their internal from the *Pia Mater* is to the *Choroides*; and their medullary Fibres paſſing thro' all, are expanded into the *Retina*, upon which the Images of Objects are painted.

The Center of this Expanſion is inſenſible, and all Rays which fall upon it are loſt; and conſequently that Point of the Object from which thoſe Rays come, is inviſible to the Eye: The Reaſon of which proceeds probably from the Blood-Veſſels, which enter with

But whatſoever its Cauſe is, there is a manifeſt Advantage in the Optick Nerves being inſerted on the Inſide of the Optick *Axes*: For if they had pierc'd the Eye in the *Axis*, then the middle Point of every Object had been inviſible; and where all Things conduce to make us ſee beſt, there we had not ſeen at all.

We muſt likewiſe have loſt ſome Part of an Object, if the Optick Nerves had been placed on the Outſide of the Optick *Axes*: Becauſe an Object may be ſo placed, as that all the Rays which come from one Point, may fall upon the Outſide of both Eyes: But it is impoſſible they ſhould fall upon the Inſide of both Eyes; and therefore that Point which is loſt in one Eye, is viſible by the other.

This ſhall ſerve for the general Theory of VISION: I ſhall now come to ſpeak of a few Diſeaſes of the Eye, by which Viſion is render'd incompleat, or totally

RACT.

Before I define a **Cataract**, 'twill be ne-ceſſary to premiſe a few Things, in Order to clear the Way for my Definition: For ſince the *Hypotheſis* I go upon is New, and not yet clearly demonſtrated, it would be look'd upon as a ſtrange Peice of Preſumption to overlook in the Groſs all the different Obje-ctions which may be made againſt it, and ſa-tisfie myſelf with only a few Probabilities (collected out of my own little Experience and Obſervation) which may ſeem to make for it.

Objection I. 'Tis Demonſtrated by the Mathematicians, that neither Corpuſcles in he *Aqueous* or *Cryſtalline* Humor can be per-eiv'd on the *Retina*; and 'tis ſaid by Phyſi-ians, that a Beginning of a **Cataract** is a uffuſion of the Eye, when little Clouds, Motes, and Flies, ſeem to float about in the Air: Now if theſe Aſſertions are both true, he would be apt to conclude, that neither he *Aqueous* nor *Cryſtalline* Humor can be he Seat of a **Cataract**: The firſt is indiſ-putable,

in Fact.

For I have known a good Number of Subjects with real Confirm'd **Cataracts**, who never remember to have been thus affected at the Beginning of them.

And altho' ſome at the Beginning of **Cataracts** are thus affected, 'tis no Proof that the Diſeaſe may not be in one or the other of theſe Humors: For the ſame Cauſe which will produce a **Cataract**, may at the ſame Time the **Cataract** is forming affect alſo the Fund of the Eye; and by diſordering the Blood-Veſſels, here and there ſtop the Influx of the Animal Spirits into the little Filaments of the Optick Nerve which help to make the *Retina*. This will certainly produce them Clouds, Motes, *&c.*

And I have the more Reaſon to believe this, becauſe I have Couch'd ſeveral who after the **Cataract** has been well ſuppreſt, have remain'd blind with a *Gutta Serena*; which is, I ſuppoſe, a total Stoppage of the Influx of the Animal Spirits into the nervous Filaments afore-mention'd.

Objection II.

the Assistance of the *Crystalline* Humor there could be no Vision; that is, except that Humor lay always ready to receive the Rays and refract them after they had pass'd the *Pupilla*, they would still proceed with so small a Degree of Refraction that their Place of Converging would be beyond the *Retina*; and by Consequence Vision would be render'd very indistinct, or perhaps the Eye would only perceive a confuss'd Glare of Light; if this Humor was taken away, and this could be demonstrated, 'twould not destroy my Supposition: For I freely acknowledge, that after the Removal of a **Cataract**, (or the *Crystalline* Humor, which as I proceed I shall use synonymously) Vision is never so perfectly perform'd as it was before the Eye was diseas'd.

And if the Subjects I have hitherto perform'd the Operation upon were of Consideration enough to have given me Pains beyond my Needle, I make no Doubt but I could have fix'd them with Glasses which would have still assisted their Sight, and made

Objection III. If Viſion can be perform'd without this Humor, and the Maxim is true *Quod Natura Nihil agit fruſtra*, Why was it placed in the Eye?

I anſwer, 'Tis placed there to enable the Eye to ſee equally well at different Diſtances: For ſince the Rays proceeding from the luminous Points of nigh Objects diverge more than thoſe from more remote Objects, the Power of making them equally converge at the *Retina* is very probably lodg'd in the *Cryſtalline* Humor; which, according to the different Diſtances of Objects, approaches nigher to, or removes farther from the *Retina*, and perhaps too aſſumes a different Convexity.

And this I look upon to be unqueſtionable: Becauſe I have made it my conſtant Obſervation, That after a ſucceſsful Depreſſure of a **Cataract**, the Patient ſees beſt at a Diſtance ſomething greater than the Eye requires when all its Parts are in their natural Situation;

Eye, Vision is render'd indistinct or confus'd.

Objection IV. But if the *Crystalline* Humor is depress'd, what becomes of it afterwards? And how is the Cavity fill'd up, which the said Humor possess'd in its natural Situation?

Answer. When I pass my Needle into the Eye, I press directly forward to the *Crystalline* Humor, and endeavouring to disengage it from the *Ligamentum Ciliare*, I depress it to the Bottom of the *Vitreous* Humor; when the *Pupilla* immediately seems clear to me, and such a Torrent of confus'd Light rushes into the Eye, as sometimes affrights the Patient even more than the Puncture of the Needle.

Common Sense tells us, That if a solid Body which is immers'd in a Fluid should be remov'd from one Part of that Fluid into another, it makes no Alteration in the Bulk of the Whole; for whatever Place the Solid is remov'd to, it fills up but so much Space precisely as it did in the Space which it

was

queous turns in and fills up the Cavity.

N. B. From the different Specifick Gravity of the *Cryſtalline* Humor, which in all Probability is different in different Stages of the Diſtemper, we may account for what is call'd the Riſing again of the **Cataract**: As to what becomes of the *Cryſtalline* Humor after 'tis depreſs'd, 'tis not unlikely that being broke from the Veſſels which nouriſh'd it, it ſhrinks by Degrees, and as it were melts into the *Vitreous*.

Dr. *Turner* ſays, A **Cataract** is a Diſeaſe of the Eye, in which a Film or Skin growing before the *Pupilla*, like a Curtain drawn againſt a Hole letting the Light into a Room, hinders the Paſſage of the ſame, till it is depreſs'd by the Needle, as in Couching.

There is no one of my Profeſſion who pays a greater Veneration to the Authority of that worthy, learned, and ingenious Gentleman, than myſelf; I am beholden to him that I have a regular, methodical, and I may venture

always more Bunglers in other Parts of Surgery than a Man of his ſtudious Temper could well attend to) very rarely, if ever perform'd the Operation, I hope 'twill not be thought Preſumption if when I come to ſpeak of the Operation itſelf, I ſhould venture to give ſome Reaſons which may ſeem to thwart his Opinion, and eſtabliſh my own.

That there are ſuch Films as the Doctor mentions on this Side the *Pupilla*, and in the *Aqueous Humor*, I can readily grant, having met with ſeveral of them in the little Courſe of my Practice: Theſe the Practitioners are allow'd to call *Suffuſions*, *Films*, *&c.* but not **Cataracts**; for I am determin'd to call no Diſeaſe of the Eye by this latter Name, except that particular One which is to be remedied by the Uſe of the Needle: But the Caſe as mention'd by the Doctor can receive no Benefit that I know of by the Operation, nor did I ever attempt to Couch a Patient tho' I have had ſeveral offer'd me) when the Circumſtances were as before-mention'd: This I ſhall endeavour to demonſtrate, in deſcribing the Operation itſelf.

The

a Film ſeparated from the *Cryſtalline* Humor, and floating in the *Aqueous*; that all its Parts are exiſtent in its firſt Conformation, that it is a *Cyſtis*, and that *Cyſtiſſes* are never form'd *de novo*, but are only Membranes diſengag'd from the neighbouring Parts, which increaſing in Thickneſs receive Nouriſhment from the Parts to which they adhere.

I ſhall beg Leave to examine this Opinion a little, and however ſpecious and refin'd it may ſeem, I am afraid we ſhall find as little Reality in it, as there is in the ordinary Profeſſion of Friendſhip amongſt the Gentlemen of their Country.

Firſt they ſay, 'tis a Membrane diſengag'd from the *Cryſtalline*, and floating in the *Aqueous*; the firſt they don't offer to prove, and the latter is falſe in Fact: For if this pretended diſengag'd Membrane ſhould float in the *Aqueous*, the Patient would have at leaſt a Chance of ſeeing now and then a little, by its being remov'd wholy or in part from before the *Pupilla*; but ſuch a Removal we find

n a conſtant equal Blindneſs, till the Cauſe
s remov'd by the Needle: I muſt beg them
hen to fix their floating Iſland, before they
retend to make a rational *Hypotheſis* of it;
nd if they do, I hope they'll be ſo kind as
o let us know to what Membranes they'll
oin it, and in what Manner it receives Nou-
iſhment from them, then we'll talk farther
vith them.

What have led the *Frenchmen* into the
Talk of its being a *Cyſtis*, and that no *Cy-
iſſes* are form'd *de novo*, is the late Diſco-
eries made by the Improvements of Micro-
copes. They are wonderfully pleas'd with
nd fond of the Opinion, that every Thing
hich is proceeds originally from an Egg or
eed; but however true this may be of per-
ect Beings, I don't expect that the ſame will
e aſſerted of the *Fungus*'s of Trees, and
ther ſupernatural Excreſcences: I can be
ery well content to believe, that Sloughs and
Mucus may be detach'd from ſeveral Mem-
ranes in the Body, and may afterwards in-
reaſe by an Addition of the ſame Matter,

and

prove presently, that 'tis impossible a **Cataract** should be in this Part of the Eye; and that will at once put an End to the Controversie.

What has given me frequent Occasion of reflecting lately, has been the odd Manner of our Authors of General Theories; they undertake to describe and define every particular Disease, with as much Freedom and Positiveness, as if they had been acquainted themselves with a good Number of Patients labouring under such Disease, and had made the Causes, Symptoms, Cure, *&c.* of it, their peculiar Study.

How just a Proceeding this is, will appear by the following Definition of a **Cataract**, in a late modern Writer of this Sort.

A Suffusion, says he, *is a thick Foulness or Excrescence, of the* Tunica Cornea, Adnata, *or* Aqueous *Humor, which when confirm'd makes the* **Cataract.**

According to this Account, any thing which thickens the *Cornea*, or makes the *Aqueous* Humor

Cataract; for he seems to use the Word Cataract not as any particular Diſeaſe, but only as ſomething which ſhall darken and obſcure the Sight, by hindring the Tranſmiſſion of the Rays of Light. Thus the *Albugo*, *Pterygium*, *Hyopyon*, or the Viſcidity of the *Aqueous* Humor, frequently conſequent upon an *Ophthalmia*, may be juſtly deem'd a **Cataract.** But how this ſquares with the real Notion of this Diſeaſe, and its Cure, I ſhall leave my Readers after a few Pages to determine.

But paſſing over all the different Definitions and Surmiſes of others, I ſhall take the Liberty (for Reaſons which I ſhall give afterwards) to define it in the following Manner.

A **Cataract** is a Diſeaſe of the *Cryſtalline* Humor, whereby the ſaid Humor is totally or at leaſt one Side of it render'd opake: The Humor in this diſeas'd State reflects all or moſt of the Rays of Light, inſtead of tranſmitting them to the *Retina*; in Conſequence of which, the Humor appears whitiſh, bluiſh, yellowiſh, *&c.* and the Eye is blind.

Any Blow or Shock, which may alter the particular Poſition of the Particles of which this Humor is compos'd: For to make a Body diaphanous, 'tis not only neceſſary that it ſhould be made of ſuch particular Particles, but that thoſe Particles ſhould be combin'd and united after a particular Manner. Thus Salts, wet Paper, or the *Oculus Mundi* Stone, grow opake by being dried; Horn, by being ſcrap'd; Glaſs, by being reduc'd to Powder, or otherwiſe flaw'd; Turpentine, by being ſtirr'd about with Water till they mix imperfectly.

The Matter which is ſeparated for the natural Nouriſhment of this Humor from the Blood, may from the too great Viſcidity of the Blood itſelf, either be ſeparated in too ſmall a Quantity, (the Glands and Strainers of theſe Parts being exceeding fine) and by this Atrophy the Humors may grow dry and opake, as Paper, Salts, *Oculus Mundi* Stone, *&c.* Or otherwiſe upon a Fever or *Ophthalmia*, the Veſſels leading to this Humor may be ſo enlarg'd, as to admit Particles of an improper

Figure

Figure or Magnitude: The Heterogeneous Particles, (if I may ſo call them) inſtead of properly nouriſhing the Humor, may be lodg'd irregularly in its Pores, (as Water and Turpentine as above) and by deſtroying that Equality which we are told is neceſſary to Tranſparency, render the Humor opake.

It may be caus'd by violent Grief, which occaſions a more than natural Secretion of Tears from an adjacent Part; this may from Continuance make ſo great a Revulſion, that the *Cryſtalline* Humor may probably grow dry, or ſuffer Diminution, for Want of its uſual Supplies. I have Reaſons to imagine this, becauſe in Eyes thus diſeas'd I have found this Humor much ſmaller than ordinary.

It may and often does proceed from an unskillful Treating of the Eye in an *Ophthalmia*, whilſt there is a more than ordinary Flux of Matter upon the Parts which ſeems to inſeat a Paſſage thro' the Coats: Inſtead of altering it forwards by kind Diſcutients, I have so frequently known it drove back by cold Repellents; and by lodging itſelf in the Coats

of its Uſe and Beauty.

Dr. *Pitcarn*, in ſpeaking of a **Cataract**, ſays, *Some aſcribe it to the thickning or coagulating of the* Aqueous *Humor, and others to that of the* Cryſtalline: *But theſe know Nothing of the Nature of the Eye; for Corpuſcles floating in the* Aqueous *or* Cryſtalline *Humor, can't be perceiv'd on the* Retina.

For once I'll run the Riſque of having my Underſtanding cenſur'd, and venture to ſay, That tho' the Corpuſcles themſelves are not ſeen being within the Eye, yet they can hinder the Eye from diſcerning every diſtinct Part of any Object which is without it: And theſe little Specks of Darkneſs, amidſt a Glare of Light, are miſtaken by the Patient for Something poſitive, when they are only Privations; and the Effect would be the ſame, if there were any Stoppages in the ſmall nervous Filaments which compoſe the *Retina*.

Thus the Doctor's Philoſophy is true, when he ſays they can't be ſeen, *&c.* But if he would pretend to infer from thence, that they can

be

Things, his Consequence is false, demonstrated to be so, by Mr. **Cheselden** at the End of his ANATOMY.

DIAGNOSTICK.

'Tis known by a Diminution of Sight in the Patient, and by Something which appears like a Bluish Cloud behind the *Pupilla*, tho' the Colour of it often varies: I do not yet know whether there be any Reason given for the Variety of Colours, but I have observ'd that the Green and Yellow are generally in old Subjects.

PROGNOSTICK.

Not so much the Age of the Person is to be consider'd, as the Age and Ripeness of the **Cataract**: I have seen both very young and very old Subjects couch'd with Success, tho' the best Prognostick is certain to be made in a middle Age and good Habit.

If a Surgeon understands the Operation, and is at all able to judge when the **Cataract** is ripe for it, he has a great deal of Reason to promise Success. If

which he can't foreſee, and ſometimes 'tis impoſſible for him to prevent, he is not to be blam'd if he miſſes of Succeſs, tho' he had ſeem'd pretty poſitive in promiſing it both to his Patient and himſelf.

Regimen *before the Operation.*

In Order to prevent an *Ophthalmia*, uſe proper Evacuations, as Bleeding, Lenient Purgatives, *&c.* a few Days before the Operation.

OPERATION.

The moſt temperate Seaſons are the beſt, for which Reaſon I make Choice of *Spring* or *Autumn.* 'Tis requiſite the Day ſhould be fine and clear, and the Light well choſen. I oblige the Patient to recline his Head backwards upon a Pillow, the Pillow is ſupported by the Back of a Chair of a proper Heighth; behind the Patient an Aſſiſtant is plac'd, to keep his Head without Motion; 'twill be neceſſary too for a Perſon on each Side, to ſecure the Hands of the Patient; for I have ſeen very ill Conſequences attend the Neglect

of this. Having thus prepar'd the Patient, I place myſelf on a Stool, rais'd by Pillows according to the Heighth of the Subject, till I have a full Command of the Patient's EYE; then bidding him turn his Eye towards his Noſe, ſo that the *Tunica Conjunctiva* may be ſufficiently apparent, I plunge my Needle directly into the *Vitreous* Humor, thro' the *Tunica Conjunctiva*, about the Diſtance of the Tenth Part of an Inch from the *Cornea*; then thruſting it boldly to the upper Part of the *Cryſtalline*, gently turn the flat Part of my Needle on the Top of the **Cataract**; by which Means I have a greater Surface upon it, and the **Cataract** conſequently leſs liable to ſlip from under my Needle: I depreſs it very ſlowly, and place it as I think at the Bottom of the *Vitreous* Humor; I don't immediately remove my Needle off it, but continue it depreſs'd for about Half a Minute, for Reaſons which I ſhall give when I come to ſpeak of the Cauſes of a **Cataract**'s riſing again: After this, I draw my Needle back about the Sixth Part of an Inch; and gently raiſing the Point, take it quite out of the EYE.

Regimen

Regimen *after the Operation.*

Immediately after the Operation I apply a Repellant Compreſs, and order the Patient to be put to Bed, raiſing his Head ſomething higher than uſual; and after ſuffering of him to remain quiet a few Hours, I renew my dreſſing, and begin to treat him with a cool *Regimen*, proper Diet, *&c.* as in a ſymptomatical Fever: This I do to ſecond the Intention of the former *Regimen*; notwithſtanding which, an *Ophthalmia* in Spite of all I can do will ſometimes ſupervene, and then it muſt be treated as ſuch.

Theſe *Ophthalmia's* are ſometimes ſo violent as to become difficult of Cure, and often produce all the Effects, and perhaps too really bring that Diſtemper upon the Eye call'd *Gutta Serena.* This laſt mention'd Diſeaſe is ſeated on the *Retina*, and may be brought on by any Thing which will enlarge the Capillary Arteries of that Membrane; for they lying contiguous to the Nerves, and their Diameters being increas'd, the intermediate Nerves are ſo preſs'd betwixt them, that the Influx of the Animal Spirits is intirely prohibited,

hibited, and all Communication is cut off betwixt them and the Original of the Optick Nerves in the Brain, which is the *Commune Senſorium:* Thus tho' the **Cataract** continues well depreſs'd, and the Eye in all Appearance perfectly clear, yet the Patient will remain Blind, and 'tis too often beyond the Reach of Art to give him any Aſſiſtance.

However, I generally uſe all the Evacuations proper in a ſtubborn *Ophthalmia*, with Calomel, Purgatives, *&c.* and keep the Patient to an attenuating Diet; obliging him to abſtain from all viſcid Nutriments, and to uſe much Exerciſe: This Method I have known to meet with its deſir'd Succeſs.

There are many other Cauſes beſides this Common One, which may render the Operation unſucceſsful; firſt, the Riſing again of the **Cataract**,

The **Cataract** will ſometimes riſe again, even before the Needle is out of the Eye: There are many ſpecious Reaſons to be aſſign'd for it, tho' perhaps none of them true; however I ſhall mention what I have hitherto imagin'd,

any Thing I ſhall here ſay if I find it contradicted by future Practice.

The firſt Reaſon (which is perhaps more obvious to others than myſelf) is, That the *Cryſtalline* Humor being diſeas'd, is become ſpecifically lighter than the *Vitreous*; and that being diſengag'd from the Membranes to which it in ſome Meaſure adhered, and depreſs'd to the Bottom of the *Vitreous*, upon Removal of the Needle it aſcends by its own ſpecifick Levity, and places itſelf at or near the Place from whence it was remov'd.

The next is, That conſiſting of very glutinous Parts, and being join'd perhaps to the *Uvea*, the Needle only removes the main Body, which ſtill remains attach'd to the *Uvea* by certain ſmall elaſtick Filaments; which as ſoon as the Needle is remov'd contract themſelves, and again lift up the *Cryſtalline* Humor into its natural Poſition.

If it remains depreſs'd for ſome Days and afterwards riſes again, but being a ſecond or third Time depreſs'd it continues where you

increas'd Viscidity in the Humor itself, or from a Rarefaction of that Fluid into which it's immers'd; both of which will perhaps be consequent upon an Inflammation, perhaps from an Elasticity in the *Cornea*, whereby the *Aqueous* Humor may be immediately thrust into its Place by Removal of the *Crystalline*; which Elasticity and Contraction of the *Cornea*, may possibly be too great to be overcome by the different specifick Gravity of the *Crystalline*.

But I must confess, if I was to give my Opinion of the general Cause of the Rising again of the **Cataract** immediately upon its being depress'd, I should imagine it to be the lifting up the Point of the Needle before I withdraw it very near back again to the Place from whence I remov'd the **Cataract.** For I imagine that the specifick Gravity of the *Crystalline* Humor, (being very little different if at all from that of the *Vitreous*) would never be sufficient to overcome the Resistance of the said *Vitreous* Humor, which is a very viscid and tenacious Fluid, unless there was a Passage made for it to rise again by that

Motion

preſs'd; and therefore hold it neceſſary that after the **Cataract** is depreſs'd, the Needle ought to be kept ſome Time upon it, that the Fluid above it may have Time perfectly to reunite; ſo as becoming all over equally tenacious, it may be impower'd to keep the **Cataract** in the Poſition we would have it.

Another Cauſe of ill Succeſs is, the wounding the *Uvea* or *Iris*; the Conſequence of which will be an irregular Form of the *Pupilla*, ſome of which I have ſeen intirely clos'd: However if they are not ſo, there is always ſuch a Calloſity upon the wounded Membrane, as ſtops up the *Pupilla* in one Part, and leaves ſuch an Opening of it on the other, that by ſtopping up the Rays where they ſhould paſs, and ſuffering them to paſs where they ſhould not, the Eye is render'd intirely uſeleſs.

Theſe Parts too, when wounded, ſometimes ulcerate; by which Ulceration, the whole Coats and Humors of the Eye become one common Maſs of *Pus*, and the Eye intirely ſinks.

The

wound the *Uvea* and *Iris* is, when he would endeavour to remove a Film which lies in the *Aqueous* Humor, or on this Side the *Pupilla*. And this, till I know better, I ſhall call an *Injudicious Practice*.

It often happens that the ſaid Coats are wounded thro' the Fault of the Patient, even when the Operation is the moſt judiciouſly perform'd; for he not having Courage to keep his Eye in the Poſition he was directed, and by endeavouring to fly from the Pain which is given by the firſt Puncture of the Needle, which he imagines is only to be done by Motion, and not being able to move his Eye any farther towards the great *Canthus*, turns it back againſt the Point or Edge of the Needle; and by this Means, in Spite of all the Art or Addreſs of the Surgeon, will with that Motion wound the Coats above-mention'd: But this laſt Accident does not happen to a Man who knows what he is doing, perhaps above Once in Twenty Times.

Another Reaſon of ill Succeſs is, the **Cataract** proving Milky: To be able to determine

with my Needle I have not yet learn'd, and ſhould be glad to be inform'd by any Body who has.

Another Cauſe of ill Succeſs, which is alſo ſometimes attributed to the Surgeon, may be a ſtrange Fondneſs of Sight, which engages the Patient after having been couch'd Three or Four Days to pull off the Dreſſings in the Abſence of the Surgeon; by which he expoſing the Eye to the Aſſaults of the open Air, brings on that *Ophthalmia* which we were endeavouring to prevent: In this Caſe he himſelf is blamable, and not the Surgeon, for all the ill Conſequences that may attend it, one of which I have found often to be the intire Loſs of Sight.

Another Misfortune, which too frequently attends the unhappy Patient, is, when the **Cataract** is accompanied with a *Gutta Serena*, perhaps of as long ſtanding as the **Cataract** itſelf; this we find when upon depreſſing the **Cataract**, (and there's no Poſſibility of judging of it before) and the *Pupilla* remaining clear, the Patient notwithſtanding continues in

plorable. I ſhould be unwilling to think that there was any Part of Mankind ſuch Strangers to common Senſe, as to imagine this to be a Fault of the Surgeon; but, I myſelf have more than once been calumniated on this very Account: I can't help ſaying, I have been unfairly dealt with by ſome of the Gentlemen of my own Profeſſion, who have miſrepreſented the Caſes, and deluded the common People, as well as injured me; this was the Caſe of Three Subjects that I lately Couch'd in *Yarmouth*.

N. B. I have met with the ſame Treatment on Account of a Subject which I Cut for the Stone, where I will undertake to demonſtrate to any Man in *England*, that it was as impoſſible to meet with Succeſs in that Operation as it was circumſtanc'd, as it is to ſucceed in the Operation of Couching where the **Cataract** is attended with a *Gutta Serena*; for unleſs a Man could directly look into the Body in the one Caſe, or down to the Bottom of the Eye in the other, he can be no more able to make a poſitive Prognoſtick, than he would be to alter the Circumſtances.

That where there is a **Cataract** in one Eye, and the other Eye ſound and good, the Patient don't ought to be encourag'd to ſuffer the diſeas'd Eye to be Couch'd; becauſe the Symptoms which may poſſibly attend it, may be the Occaſion of the Loſs of both.

I ſhall take the Liberty of mentioning a Caſe of my own, wherein I have met with ſome of the afore-mention'd Accidents. About Five Months ſince, a Patient came to me with a Confirm'd **Cataract** in one Eye, and a Suffuſion in the other. I found the **Cataract** good, and (after the common Preparations) depreſs'd it with no apparent ill Accident. The Eye continu'd clear, and the Patient ſaw for ſome Days: At which Time an Inflammation came on, which equally affected both Eyes; and, notwithſtanding all I could do to abate it, the Coats and Humors were ſo thicken'd by it, that the Eye which had the Suffuſion in it became totally blind: And ſome Time after, that which I had couch'd was in like Manner intirely deprivd of Sight; tho' the **Cataract** remain'd depreſs'd, and the *Pupilla* perfectly clear.

Obſervation.

the Suffusion above-mention'd was Nothing more than the Beginning of a **Cataract**, caused by the *Crystalline* Humor growing thick and muddy: And that this Inflammation, by increasing the Viscidity of the Matter separated for the Nourishment of the said Humor, increas'd the Thickness so, as to render the Humor intirely opake; or in other Terms, ripen'd the **Cataract.** The Reason why I did not venture to Couch it afterwards was, an uncommon Dilatation of the *Pupilla*, which had been from the Beginning of the Suffusion: The Disease of the other was a direct *Gutta Serena*, caus'd by the Inflammation in the Manner before describ'd.

The Subject I have been treating of being altogether new, I shall beg Leave to add the following Queries, to be consider'd by the Gentlemen of my Profession, not troubling myself whether they make for or against my *Hypothesis*.

Query I. Whether the Reason of the Dilatation of the *Pupilla* in one Eye and not the other may not be this: That the *Crystalline*

rent than formerly, the Patient finds that the Rays of Light do not ſtrike ſo clearly and forcibly as they us'd to do; or in other Words, the Eye is darker than in its natural State: To amend which, he naturally and one may almoſt ſay involuntarily dilates the *Pupilla*; in order to receive more Rays of Light, and recompenſe the Defect of the diſeas'd Humor?

The ſame is done whenever we want to ſee Objects in the Dark; but in this caſe the Cauſe remaining conſtant, the Dilatation is conſtant too, till the *Pupilla* by the frequent Uſe of this Motion becomes actually wider than it ought naturally to be. In ſuch a Dilatation as I here mention, we can't promiſe any great Succeſs from the Uſe of the Needle: For was the Humor itſelf perfectly clear, ſuch a dilated *Pupilla* would admit ſuch a Glare and Flow of Rays to the *Retina*, as would render Viſion confus'd and indiſtinct; much leſs can we hope to have a good Eye, when that Humor ſo neceſſary to Viſion is intirely removed.

Query II.

times appearing at first in a white Point, and afterwards ſpreading itſelf like a Line drawn from a Center to a Circumference, is not a Proof that 'tis a tranſparent Body already form'd, growing thick and cloudy, rather than the Beginning of a new Membrane?

N. B. The Compoſition of the *Cryſtalline* Humor, in the Anatomy of the Eye.

Query III. Whether **Cataracts** very old and diſcolour'd, declining in the ſame Manner, and becoming angulous and uneven, is not a Proof of the ſame Thing?

Query IV. Whether it would not be worth while to obſerve after the Couching a young Subject, if the ſame Subject is ever troubled with a ſecond **Cataract**, properly diſtinguiſhing whether it bethe ſame **Cataract** riſen again or not? And this I think is beſt to be done, by obſerving the Interval of Time which paſſes between his being Couch'd and the Appearance of this ſecond **Cataract**. Whether if this Obſervation be juſt, and a ſecond **Cataract** be form'd in the ſame Eye, and

my *Hypothesis*?

Query V. Whether our not being able to remove a **Cataract** at its first Appearance, is not a Proof that 'tis not the *Crystalline* Humor? Because for all what we know certainly, the *Crystalline* Humor is equally removable at all Times.

Query VI. Whether or no in that Stage of the Disease which we call a *Milky* **Cataract**, there may not be such a Solution of Continuity of the Parts of the *Crystalline* Humor, as may suffer the Needle to pass backwards and forwards in it, without being able to remove it out of its Place?

Query VII. And whether in a farther Stage of this Disease, the Parts may not again close, and stick together in such a Manner, as that the whole Body of the Humor may be at once remov'd, by only pressing upon a particular Part of it?

Query VIII. Whether there may not be a Gradation of Colouring settled from Sir *Isaac Newton's*

and ending at a greenish Yellow; whereby we might be able to determine the exact Age of a **Cataract**, as soon as we see it? And whether such a particular Colour will or will not successfully bear the Needle?

Query IX. Whether 'tis not possible to invent a *Speculum Oculi*, which may keep the Globe of the Eye without Motion, and without giving that Pain to the Patient which too frequently contributes to the bringing on of an Inflammation? I mention this, because I have seen so many Inconveniencies attend the Use of the Common *Speculum Oculi*; that, rather than use it myself, I have chose to have Nothing to assist me, except the Pressure of the Thumb and Finger?

Query X. Whether a Trembling, which I have observ'd in the *Aqueous* Humor some Time after Couching, does not proceed from a Loss of Part of that Humor in Couching? And whether this Trembling is one Reason why the Rays of Light pass confus'd into the Eye?

Needle to paſs between the *Cryſtalline* Humor and the *Uvea*, without removing the former ſo as to ſpoil the Eye, or cutting or lacerating the latter?

Query XII. Whether, if this laſt is practicable, there's not a Poſſibility of removing a Film that may be in the Forepart of the *Pupilla*, notwithſtanding the Needle enters in at the Backpart of it?

Query XIII. Whether there might not be a nice Experiment made, by placing an Eye like a *Lens* in the Hole of a dark Chamber? I think (if I remember rightly) I have met with the following Account in an Author of Experimental Philoſophy. Stripping the Fund of the Eye of its Integuments, he plac'd it as above-mention'd; and holding a Peice of white Paper within the Room, at a ſmall Diſtance from the Eye, he diſtinctly perceived the Images of all Objects from without painted upon the Paper; as they would have been upon the *Retina*, if the Eye had been in its natural Poſition.

Had

have gon on the Outſide and with a Needle as in Couching depreſs'd the *Cryſtalline* Humor, and if notwithſtanding this Depreſſion the Perſon within could ſtill perceive the Images as before, it would be a certain Proof that the Eye might ſee, notwithſtanding the Loſs of the *Cryſtalline* Humor.

The Eye ſhould be taken down, and diſſected; and by obſerving in what Part the *Cryſtalline* Humor after its Removal was lodg'd, we ſhould receive a great Light into the Theory of Couching, and much Satisfaction as to the Truth of this *Hypotheſis*.

I only mention this as it ſeems to me poſſible, without being able to determine whether 'tis practicable or not.

CONCLUSION.

Before I conclude, I thought it my Duty to mention, (and in the Words of a Great Man) That as a candid and ſincere Behaviour ought to be preferr'd to all other Conſiderations, I would not let my Heart reproach

gain'd even the Possibility of a Praise, which is not in every Particular my Right: I therefore thought proper to acknowledge, that I am oblig'd to a very ingenious Gentleman (whom I have the Honour to be acquainted with) for Two or Three Hints that he has given me in the latter Part of this short Dissertation, which otherwise probably might have been omitted.

N. B. I believe it will be necessary to observe to such Persons as are not Judges of the Subject I have been treating of, That I have therein demonstrated the Reason of my not meeting with Success in some Patients that I have Couch'd, particularly in *Yarmouth.*

FINIS.

ESSAY

UPON

SINGLE VISION WITH TWO EYES:

TOGETHER WITH

EXPERIMENTS

AND

OBSERVATIONS

ON

SEVERAL OTHER SUBJECTS IN OPTICS.

By WILLIAM CHARLES WELLS, M. D.

LONDON:

PRINTED FOR T. CADELL, IN THE STRAND.

1792.

165251

CONTENTS.

ESSAY

UPON

SINGLE VISION WITH TWO EYES.

PART I.

Of the different Opinions concerning Single Vision with two Eyes; and principally of those of Dr. Smith and Dr. Reid, - p. 1.

PART II.

Of a new Theory respecting Visible Direction, and of a Solution hence derived of the Question, why Objects are seen single with two Eyes, - - - p. 34.

PART III.

Of some Consequences from the foregoing Theory of Objects being seen single with two Eyes; together with the Explanation of several other Phenomena of Vision, p. 63.

EX-

EXPERIMENTS *and* OBSERVATIONS

ON

SEVERAL SUBJECTS IN OPTICS.

ARTICLE I.

On Visible Position and Visible Motion, p. 85.

ARTICLE II.

On a supposed Consequence of the Duration of Impressions upon the Retina; and the Effects of accurate Vision being confined to a single Point of that Membrane, p. 106.

ARTICLE III.

On the Connection between the different refractive States of the Eyes, and the different Inclinations of the Optic Axes to each other, - - - p. 116.

ARTICLE IV.

On the Limits of Perfect or Distinct Vision, p. 131.

AN

ESSAY

UPON

INGLE VISION WITH TWO EYES.

PART I.

Of the different Opinions concerning ſingle Viſion with two Eyes; and principally of thoſe of Dr. Smith and Dr. Reid.

THE end I have chiefly in view, in this ſſay, being to offer a new ſolution of the ueſtion, why objects are perceived ſingle ith two eyes, I think it incumbent upon ıe, in the firſt place, to ſhow, that none of ıe opinions I have met with upon this ıbject, can be admitted as juſt.

Theſe opinions, or ſuch of them at leaſt s have gained any conſiderable reputation,

may be reduced into two classes. The first comprehends those of Galen, Alhazen, Rohault, Dr. Briggs, and Sir Isaac Newton, all of whom have regarded the question I have mentioned as equivalent to the following one: Whence comes it, that the mind should be affected with only one perception from two impressions upon the external organs of sight, since either of those impressions is, of itself, sufficient to produce a similar perception? Their universal answer has been: Because the two impressions are united before they are communicated to the mind. And the only difference among these authors, has been with respect to the manner in which such an union takes place. To the second class are to be referred the opinions of those, who hold it as certain, that an object is seen single by both eyes, because it is seen by each of them in the same external place; and who profess to point out some law, or constant rule of vision, from which this sameness of place is to be derived as a necessary consequence. Aguilonius, I believe, first gave

this

this view of the queſtion, which has ſince been adopted by Dechales, Dr. Porterfield, Dr. Smith of Cambridge, and Dr. Reid of Glaſgow.

In opposition to the opinions of the firſt claſs, more eſpecially as they have been repeatedly examined by others, I think I need only ſay, that they muſt all be conſidered as mere conjectures, founded upon certain ſuppoſed changes in the brain and nerves, the exiſtence of which it is impoſſible, from the nature of the parts, either to demonſtrate, or to refute by experiments; and that no one of them, though admitted to be true, is yet ſufficient to explain the phenomena on account of which it was framed.

The opinions of the ſecond claſs being built, as their authors think, upon experiments and obſervations, both allow and demand a more accurate inveſtigation. I ſhall proceed, therefore, to examine ſuch of them as I am acquainted with, beginning with that of Aguilonius; and what I ſhall obſerve concerning it will apply alſo

to thoſe of Dechales and Dr. Porterfield, who have done little more than copy what he has ſaid.

If a line be drawn through the point of the mutual interſection of the optic axes, parallel to the interval between the eyes, Aguilonius calls it, from its office, the *horopter*; and if through this line, a plane be made to paſs at right angles to that of the optic axes, he names it the *plane of the horopter*. After defining theſe terms he aſſerts, that, by a law of our conſtitution, all bodies which we ſee with one glance or look, whatever are their real places, appear to each eye to be ſituated in this plane.— And if this be granted to him, he eaſily and ſatisfactorily ſhows, why ſome ſhould be ſeen ſingle with two eyes, and others double. For ſince, according to a ſecond opinion maintained by him, and not contradicted, I believe, by any other writer upon viſion, the two lines of direction, in which an object is ſeen when we employ both eyes, can meet each other only in one point, it follows, that all bodies which are

really ſituated in the plane of the horopter, muſt neceſſarily appear ſingle, as the lines of direction in which any one of them is perceived by the two eyes, coincide in that plane, and no where elſe; and that all bodies, which are not ſituated in the plane of the horopter, muſt as neceſſarily appear double, ſince, in this caſe, the lines of their viſible directions interſect each other, either before or after they paſs through it.*

Againſt the truth of this explanation, only one argument need be offered.—Were the viſible places of all bodies to be contained in the plane of the horopter, theſe would appear of magnitudes proportional to the angles which they ſubtend at the eye. A finger, for inſtance, held near to the face, would ſeem as large as the part of a remote building it might conceal from the ſight. But as this is contrary to experience, the principle from which it is derived, muſt be rejected, together with all its conſequences. To Aguilonius, however, the merit is due of being the firſt, who ſo

* Aguilonii Optica, p. 110, 148, 331, 344.

ſo far generaliſed the phenomena of ſingle and double viſion, as to obſerve, that thoſe objects alone are ſeen ſingle, which are really ſituated in the plane of the horopter.

The opinion of Dr. Smith is the next in the order of time. *" If it " be aſked (ſays that author) why in " ſeeing with both eyes we do not al- " ways ſee double, becauſe of a double ſen- " ſation, I think it is ſufficient to ſay, " that in the ordinary uſe of our eyes, " in which the pictures of an object are " conſtantly painted upon † correſpond- " ing places of the retinas, the predomi- " nant

* Compleat Syſtem of Optics. Vol. I. p. 48.

† Dr. Smith gives the following definition of *correſponding points*. " When the optic axes are parallel or meet in a point, " the two middle points of the retinas, or any points which are " equally diſtant from them, and lie on the ſame ſides of them, " either towards the right hand or left hand, or upwards or " downwards, or in any oblique direction, are called *correſpond-* " *ing points*." Vol. I. p. 46. According to this definition, points correſpond which have a certain agreement in ſituation. No contradiction is, therefore, implied in this ſyſtem by ſaying, that an object may appear ſingle, though its pictures ſhould fall upon points which do not correſpond. Dr. Reid's definition of the ſame term is very different.

" nant ſenſe of feeling has originally and
" conſtantly informed us that the object is
" ſingle. By this means our idea of its
" outward place is connected with both
" thoſe ſenſations, as is manifeſt by its
" appearing in two places when its pictures
" are not painted upon correſponding places
" of the retinas; which is only a direct
" conſequence ariſing from our general ha-
" bit of ſeeing." Should any one now enquire whence it is, that, to produce ſingle viſion, all men agree in directing their eyes toward the object in ſuch a manner, as to receive its pictures upon correſponding points of the retinas, ſince cuſtom might have connected the ſenſations of any other two points with the information of its unity from feeling :* This anſwer may be given in the words of Dr. Smith : † " When we
" view an object ſteadily, we have acquired
" a habit of directing the optic axes to
" the

* This objection is made to Dr. Smith's theory by Dr. Reid, who ſeems to have overlooked the anſwer. Reid's Inquiry into the Human Mind, 8vo. p. 232.

† Vol. I. p. 46.

" the point in view; becauſe its pictures
" falling upon the middle points of the
" retinas, are then diſtincter than if they
" fell upon any other places; and ſince
" the pictures of the whole object are equal
" to one another, and are both inverted
" with reſpect to the optic axes, it follows
" that the pictures of any collateral point
" are painted upon correſponding points of
" the retinas."

Such is the ſolution which Dr. Smith has given of this celebrated queſtion, and ſuch the reply, which his general account of viſion furniſhes to one objection againſt it. But there are others which, in my opinion, cannot be ſo eaſily repelled. Before I offer theſe however, I beg leave to remark, that although it were proved, as I think it may be, that he is miſtaken in the fact of objects appearing ſingle, when their pictures fall upon the middle or other correſponding points of the retinas, ſtill the truth of what is peculiar to him * of the ſolution he

* Dr. Reid attributes to Biſhop Berkeley the opinion, that objects appear ſingle to two eyes, from an experienced connection between

he gives, might remain unmaken.— Objects, it may be ſaid, are conſtantly ſeen ſingle when we direct our eyes to them in a particular manner. Their pictures muſt, conſequently, in every ſuch caſe, fall upon the ſame places of the retinas; and whether theſe be correſponding or not, the unity of the viſible appearances will be owing to the connection, which has uniformly been obſerved between the ſenſations of thoſe places, and the information from feeling, that the objects which cauſe them are ſingle. What I ſhall ſay, therefore, upon his opinion, will tend to ſhow, that, admitting the fact reſpecting correſponding points to be true, his explanation of it ought however to be rejected.

For *firſt*, it may be obſerved, that, if we are taught by *feeling* to ſee objects ſingle,

between particular ſenſations of ſight, and the informations of touch. But I no where find it mentioned in the works of that author; and I even think it probable, that he purpoſely avoided treating of the queſtion, as he found, that the ſolution of it, which naturally flowed from his principles of viſion, was with difficulty to be reconciled to other concluſions he had derived from the ſame ſource.

notwithſtanding a ſenſation in each eye, the informations of the former ſenſe ought to be uniform, or elſe one ſet of viſual appearances would be aſſociated with different reports from feeling, and no certain mark afforded us which of them we ſhould truſt. Now Dr. Smith himſelf is obliged to confeſs, that we ſometimes *feel* double, "as "in the dark, when a button is preſſed "with two oppoſite ſides of two contiguous "fingers laid acroſs; for this reaſon, that "thoſe oppoſite ſides of the fingers have "never been *uſed* to feel one but always "two things at a time." * He adds, "We "have learned, therefore, by experience of "both ſenſes compared together, to make "their informations conſiſtent with each "other." Here then we find him to allow, that feeling is not always the predominant, but ſometimes the inferior ſenſe; that its informations are not conſtant and original, but changeful and derived; poſitions directly

* Vol. I. p. 48. Dr. Smith however has, from the influence of ſyſtem, I ſuppoſe, miſtaken this fact; for the button is *felt* double, when preſſed in the manner above mentioned, though we ſhould not be in the dark, and ſhould even *ſee* it to be ſingle.

rectly contrary to those he had immediately before maintained. But in the first instance of difference between the informations of the two senses, what rule had we for determining which was the most worthy of credit? How does a blind man correct his errors of touch? If the button be felt double, because pressed by two parts *not* accustomed to feel the same thing at the same time, there must have been a period in the life of every person, when a body pressed by any two parts would have been felt double, by three parts triple, and so on. Nor could sight have corrected those deceptions, if they can be called such; for every thing by the same hypothesis must then have also been seen double. How came we therefore, both to feel and see things single? Surely not by comparing the informations of the two senses together.

But *secondly*; were we to grant, that the sense of touch has originally and constantly informed us that objects are single, it would not follow, that we are thence taught to *see* them also single. For since the place,

 which

which an object ſeems to either eye to poſſeſs, manifeſtly depends both upon its apparent diſtance, and its apparent direction from that eye, if viſible place be, in the language of Dr. Smith, only an *idea* of real or tangible place, viſible direction muſt bear the ſame relation to tangible direction; a conſequence of which is, that we can never have a more accurate knowledge of the direction, in which an object may lie from any part of our bodies, by ſight than by touch. Facts however prove the contrary. Let any perſon, for inſtance, taking a pin in his hand, endeavour, without looking, to bring its head upon a level with either of his eyes; and there are many chances to one but he will fail in the attempt, of which ſight will inform him, when he turns his eye to the object. This to me is a convincing argument, that external bodies are not ſeen in certain directions, becauſe they have been previouſly felt in them; and conſequently, that viſible place, of which viſible direction is a component part, is not merely a repreſentative of the place perceived

ceived by touch. But if the place, in which an object appears to each eye separately, does not entirely depend upon any lesson from feeling, the inference is, that when an object appears in one and the same place to both eyes together, neither is this effect to be attributed solely to the informations of that sense.

Thirdly; in whatever direction an object may appear to either eye, it certainly cannot be seen in the same place by both, except at some point common to the two directions. Dr. Smith acknowledges this, and says, * that when an object is perceived single with both eyes, it is seen at the mutual intersection of the two visual rays; the visible direction of any object coinciding, according to him, with the visual ray, or the principal ray of the pencil which flows from it to the eye. Should we then even allow, that all we know by sight of the places of bodies has been borrowed from feeling, it will still be easy to show, that the rule of vision for each eye, which he has

Vol. II. Remarks, p. 86.

has derived from ſuch experience, that of our ſeeing objects in the directions of their viſual rays; is inconſiſtent with many of the phenomena of ſight with two eyes; and conſequently, that he has left unremoved the chief difficulty of his ſubject, which was to explain the ſingle appearance of objects to both eyes, from thoſe laws, or rules of viſion, which affect each of them ſingly. For it is a well known fact, that if two bodies of the ſame ſhape, ſize, and colour, be placed, one in each optic axis, they appear but as one body, provided they be at equal diſtances from the eyes. Agreeably to the theory of our ſeeing objects in the direction of their viſual rays, this cannot happen, except the united body appear at the interſection of the optic axes. Dr. Smith accordingly, * maintains that it does. Now, in the firſt place, I appeal to experiment for a direct proof that it does not; and in the ſecond, I obſerve, that, as the two bodies in the optic axes appear as one, whether they be ſituated within or beyond the

* Vol. II. Remarks, p. 86.

the concurrence of thoſe lines; and as a right line joining the bodies, and extended both ways, appears at the ſame time to the ſight as a right line; it follows, upon admitting the fact which I have denied, that all objects in the plane of the optic axes which are ſeen in one poſition and ſtate of the eyes, however near to us, or however remote they may in reality be, muſt appear to be equally diſtant, or rather in a line drawn through the concourſe of the optic axes, parallel to the interval between the eyes, and named by opticians the *horopter*. Again, if a right line be made to paſs through any part of the plane of the optic axes, at right angles to it, the portions above and below this plane are perceived to be in the ſame right line with the point which is ſituated in it, and the whole appears perpendicular to the plane. But the point in the plane is ſeen, by the laſt article or propoſition, in the horopter; the whole, therefore, of the perpendicular line muſt be ſeen in a plane paſſing through the horopter at right angles to that of the optic axes; or in other

words, in the *plane of the horopter*, in which conſequently all bodies will have their viſible places. But this was the very opinion of Aguilonius, to which he was probably led by a ſimilar train of reaſoning; though, as a teacher, he might chooſe rather to ground it immediately upon an original law of our conſtitution.

It is probable, however, that Dr. Smith did not perceive the concluſions which might be drawn from his doctrine of objects being ſeen in the directions of their viſual rays, ſince he has no where ſpoken of them. At any rate, it is manifeſt he did not admit them, as he has mentioned the following circumſtance as a fact,* to which they cannot be reconciled; that, when an object is ſeen double, both its apparent places are ſituated between its real place, and the mark at which we look. For, if this were juſt, together with what he has elſewhere advanced, phenomena ought in many caſes to be obſerved, very different from thoſe which are in truth found to exiſt. Thus, for

* Vol. I. p. 48.

for example, if a right line be any where placed in the plane of the optic axes, it follows, from what he has ſaid in one part of his book, that thoſe points of it, through which the axes paſs, muſt be ſeen united at the mark we look at, the axes croſſing each other there; and from what I have juſt quoted, that every other point muſt be ſeen by each eye between its real place and that mark. The appearances, therefore, of all the points, if they do not lie disjoined, but are connected together in ſome orderly manner, will be arranged in the forms, either of two curves, both paſſing through the interſection of the optic axes, or of four right lines meeting one another at that point. If the right line be placed nearer to the face than the mark we look at, the apparent lines, whether curved or ſtraight, will approach toward us from their common point, but recede from us, if the real line be ſituated beyond the mark. Such are the phenomena which ought to follow upon the admiſſion of theſe two parts of Dr. Smith's theory of viſion with two eyes, but

 which

which are not found to exiſt in nature.—Aguilonius was at leaſt conſiſtent when he maintained, that all objects are ſeen in the plane of the horopter; while Dr. Smith, by deſerting that opinion in part, ſeems only to have involved himſelf the more deeply in error.

Having now ſaid what, I hope, will be thought ſufficient to ſhow, that the reaſon given by Dr. Smith, for our ſeeing objects ſingle with both eyes, is neither grounded on well-atteſted facts, nor adequate to the explanation of the phenomena obſerved, I paſs to the examination of the opinion of Dr. Reid.

As this neither reſts upon, nor includes any new fact in viſion, I need only mention, in order to give an account of it,* that its author maintains with Dr. Smith, that an object is ſeen in the ſame place with both eyes, and conſequently ſingle, when its pictures fall upon the centres of the retinas, or upon points in them, which are ſimilarly ſituated with reſpect to the centres; but differs

* Inquiry into the Human Mind, c. v. ſect. 13.

differs from him in this, that he makes the property to be original, by which any two places in thoſe membranes exhibit only one object, while Dr. Smith derives it altogether from cuſtom.†

In my examination of the opinion of Dr. Smith, I took occaſion to remark, that the truth of what diſtinguiſhed it from all others might remain unſhaken, though it were proved, that objects do not appear ſingle, when their pictures occupy any of the correſponding points of the two retinas, ſince cuſtom might have aſſociated the perceptions of touch, with the ſenſations of any other parts whatſoever of thoſe membranes. The ſame obſervation will not apply with equal juſtice to the opinion of Dr. Reid. On the contrary, could it be ſhown, that the places of the two retinas, which repre-

† They differ alſo with reſpect to the meaning of a term; Dr. Smith calling *correſponding points*, ſuch as have the poſition juſt mentioned, whether they repreſent objects ſingle or not; whereas Dr. Reid ſays, that thoſe points correſpond, whatever their poſition may be, which repreſent objects ſingle; and he appears to me not always to attend to the double uſe of the ſame term, when he ſpeaks of the opinions of Dr. Smith.

ſent an object ſingle when each receives its picture, are not the centres, or ſuch others as are ſimilarly ſituated, an obvious inference would be, that the ſingle appearance of the object is not occaſioned by a property in thoſe places, beſtowed upon them for this ſpecial purpoſe by nature; it being reaſonable to expect, that ſuch a property ſhould be found, if any where, in thoſe parts of the retinas which are the moſt like to each other. I have, therefore, reſerved till now, the obſervations which have occurred to me upon this ſubject, and which, when ſtated, muſt, at leaſt, raiſe ſome doubt concerning what has been regarded as true by Dr. Smith and Dr. Reid, and by almoſt every other writer on viſion, ſince the time of Kepler.

Anatomiſts have commonly taught, that the centres of the ſphores, to which the cornea, the ball of the eye, and the two portions of the cryſtaline belong, are all placed in the ſame right line, hence called the optic axis, and that this being produced both ways, paſſes through the centres of

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the cornea and retina, conſidered as ſurfaces. Opticians, on their part, obſerve, that an object appears ſingle to both eyes, when the axis of each is accurately directed to it; from which they infer, that the centres of the retinas agree in ſuggeſting but one object, though each receives its picture.—Again; ſince it is known by experience, that, while any object is ſeen ſingle, to which the optic axes are turned, others at the ſame diſtance from the eyes likewiſe appear ſo; and ſince the pictures of theſe lateral objects fall upon points in the two retinas, equidiſtant from their centres, and both upon the ſame ſide, that is, both to the right or left of the centres, or both above or below them, opticians conclude, that every two places of the retinas, which are ſimilarly ſituated with reſpect to the centres, muſt alſo agree in exhibiting but one object, though pictures are received by both.

But the whole of this reaſoning is built upon a circumſtance in the fabric of the eye, which has been ſhown by ſome of the

moſt

moſt eminent anatomiſts not to have place. For Varolius * long ago obſerved, that the cryſtaline is not ſituated in the middle of the eye, but more *inwardly*; and the accurate Zinn † has more lately mentioned, that if the eye be divided into a right and left half, the centre of the cryſtaline will be found in the inner portion. Haller ‡ confirms this fact; and Winſlow's ‖ obſervation, that the centres of the pupil and iris do not coincide, but that the former is nearer to the noſe than the latter, is connected with it; ſince both Zinn and Haller agree, that the centre of the pupil is placed in the axis of the cryſtaline, while that of the iris is evidently in the common axis of the cornea and globe. Now, a conſequence of this poſition of the cryſtaline is, that, contrary to what I believe is univerſally maintained, no ray of light whatſoever can paſs unbent to the retina from the atmoſphere, or any other medium differing in refractive

* Varolii Anatomia, 12mo. p. 16.

† De Oculo, 4to. p. 127.

‡ Elementa Phyſiologiæ, tom. v. p. 403.

‖ Winſlow's Anatomy, vol. ii. p. 379. Engliſh edition, 8vo.

fractive power from the aqueous humour. If, then, the line joining the centres of the cornea and globe of the eye be what is called the optic axis, and if it be true, that objects appear single when we direct both these axes to them, it must be evident, to such as are acquainted with the common rules of optics, that the pictures of those objects do not fall upon the centres of the retinas, but more internally; and, therefore, that the centres and all the other points of those membranes, which by the present system are supposed to represent objects single, do in fact exhibit them double.

It will be said here, perhaps, that the line * passing from each eye, which we turn to objects when we see them single, is not a pro-

* I am of opinion, that this line, or at least the line which we turn to objects when we see them most distinctly with one eye, is not the common axis of the globe and cornea. For I find, that, when I place the flame of a candle between either of my eyes, and a plane mirror, in such a manner that it may conceal its own image in the mirror from the sight of that eye, or rather that it may be a little below this image, but in the same vertical plane with it, the image of the flame, seen by reflection from the cornea, does not appear upon the middle point of this coat, but upon that point of it which is opposite to the centre of the pupil.

a production of the common axis of the cornea and globe, but ſome other, diſpoſed in ſuch a manner, that the pictures of thoſe objects are received by the centres of the retinas. I anſwer; I readily grant the poſſibility of the thing, but I aſſert at the ſame time, that we have no proof of it, which is a ſufficient reaſon for rejecting every concluſion that depends upon its truth.

Admitting, however, that objects are repreſented ſingle, when their pictures fall upon the centres of the retinas, or upon any other two points which are equally diſtant from the centres, and both upon the ſame ſide, it appears to me, notwithſtanding, to be in violation of all analogy, to aſcribe this effect, with reſpect to the points, at leaſt, on the right and left ſides of the centres, to any peculiar property which they poſſeſs from nature. For when anatomiſts find, in a new ſpecies of animals, organs ſimilar in ſtructure to thoſe of others they are already acquainted with, they immediately conclude, that they are alſo ſimi-

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far in regard to their use. In animals of the ſame ſpecies, they believe with certainty, that the organs they ſee in one have the ſame properties, as the correſponding organs of another; and, if it be poſſible, they attribute with greater certainty the ſame properties to two organs of the like kind, which are found in the ſame individual. Such is the influence of the rule, that reſemblance of property is implied by reſemblance of ſtructure. Now it is an univerſal fact, that if an animal be divided into a right and left half, the correſponding parts of thoſe organs, which exiſt in pairs, are found at equal diſtances from the plane of partition. Thus, for inſtance, in reſpect to the eyes, the two optic nerves penetrate their outward coat at the ſame diſtance from this plane. Their muſcles, blood-veſſels, and every other of their component parts and appendages, are arranged in the like manner; thoſe neareſt to the dividing plane, or the innermoſt, in the one, being ſimilar in ſtructure to the innermoſt in the other, the outermoſt to the outermoſt, and the inter-

mediate to the intermediate, It is ſurely, therefore, natural to expect, that ſuch parts ſhould alſo be ſimilar in their properties; and we in fact find this ſimilarity to exiſt, wherever it can be clearly aſcertained what the properties are. Every perſon, for example, admits, that the internal ſtraight muſcle of the right eye performs the ſame office, with reſpect to that eye, as the other internal ſtraight muſcle does with reſpect to the left eye. What judgment are we then to form of the opinion of Dr. Reid, which attributes the ſame original properties, or rather the joint poſſeſſion of one original property, to places in the retinas ſituated at unequal diſtances from the general plane of partition; which makes an *external* point in one to correſpond, in uſe, with an *internal* point in the other, and this too by a principle implanted by nature? If ſuch things exiſt, they may, at leaſt, be ſaid to ſtand oppoſed to a moſt extenſive analogy.

To theſe arguments, *a priori*, againſt the opinion of Dr. Reid, I ſhall now add others, which

which are derived from a conſideration of its conſequences.

Firſt; Since viſible place, as was formerly obſerved, includes in it viſible diſtance, it is evident that, if both eyes, by virtue of an original property, ſee an object in the ſame place, diſtance muſt alſo be originally perceivable by ſight. Dr. Reid, * however, has himſelf ſo ably ſhown, that we would never have acquired, by means of our eyes, any knowledge of diſtance, unleſs they had been aſſiſted by the ſenſe of feeling, that I forbear to ſay any thing more upon this head, than that the exiſtence of no property can be admitted, which leads to the concluſion I have ſtated.

Secondly; If diſtance be not immediately perceivable by ſight, the only manner, in which an original property of the eyes can affect the viſible places of bodies, is by occaſioning them to appear in certain directions. Now Dr. Reid maintains, † that every external point is ſeen in the direction of a line

* Inquiry into the Human Mind, chap. 6. ſect. 3 & 20.

† Ibid. chap. 6. ſect. 12.

paſſing from its picture on the retina, through the centre of the eye. If, therefore, this direction be the ſame as that ſuggeſted by the original property ſo often mentioned, the latter law is merely another expreſſion for the former, and ought to be rejected as ſuperfluous. If it be different, and ſhould the two laws exiſt together, objects ſeen with both eyes might ſometimes appear quadruple, ſometimes triple, but never ſingle. Were they to exiſt ſucceſſively, one when we employ one eye, the other when both, an object, though at reſt, ſhould always appear to move when viewed alternately by one and by both eyes; neither of which concluſions is agreeable to experience.

Thirdly; To ſhow in a different way, and one perhaps more eaſily underſtood, that the opinion of Dr. Reid is not conſiſtent with the phenomena of viſion it ought to explain, I ſhall ſuppoſe an experiment to be made upon a perſon who ſquints. But I muſt premiſe, that it appears, from the

obſervations of Dr. Jurin * and himſelf, † that all ſuch perſons have one eye of a weaker ſight than the other; that when both eyes are open, the weaker is turned away from objects, which are attentively viewed; but that when the ſtrong eye is cloſed, the weaker is pointed to objects, exactly as the former would be in the ſame ſituation; and that it likewiſe perceives them in ſimilar directions. Let now the ordinary poſition of the perſon's eyes, upon whom the experiment is made, be ſuch, that the optic axes interſect each other about an inch or two from the face; and while the other is cloſed, let the flame of a candle be placed in the axis of the weak eye, which I ſhall call the left, at the diſtance of ſome feet from it, and on the right ſide of the body. The flame will conſequently appear in the ſame direction, as if his eye had no fault, and will be ſeen on his right, where it is in reality ſituated. Both eyes retaining the ſame poſition with reſpect to his head and each other, let the weak

* Smith's Optics. Vol. 2. Remarks, p. 30.

† Inquiry, chap. 6. ſect. 16.

weak eye be afterward ſhut, and the right opened, and let another object be placed in the axis of the latter, an opake body being at the ſame time ſo diſpoſed, as to hide from it the candle which is in the axis of the left eye. This object in the right axis will conſequently appear on the left ſide. Now, ſince the two objects, which have been thus viewed ſeparately, are ſituated, one to the right, and one to the left; and ſince they have been alſo *ſeen* in thoſe poſitions, their viſible places muſt be two, as well as their tangible, and muſt be remote from each other. How then ſhould theſe objects appear, if, inſtead of being viewed alternately, each by the eye in the axis of which it is placed, they were ſeen by the two together; the poſitions and internal ſtates of the eyes being in both caſes the ſame? Dr. Reid muſt anſwer; They will poſſeſs but one viſible place, ſince their pictures fall upon the centres of the two retinas, points endowed with the original property of repreſenting objects ſingle. But where is this one place

to

to be found? In the axis of the right eye, or in that of the left, or between the two? In any of theſe caſes, or in any other that can be imagined, the law of viſible direction, ſo much inſiſted upon by Dr. Reid, that objects appear in the perpendiculars to their pictures upon the retina, and in truth every other law of viſible direction hitherto publiſhed, muſt be ſuſpended with reſpect to one or both eyes; unleſs, indeed, the united object be referred to the interſection of the optic axes, about an inch or two from the face. This, I believe, Dr. Reid would not readily admit; but if he ſhould, another caſe of ſquinting may be imagined, in which the optic axes recede from each other, and where the ſame reaſoning will apply without the poſſibility of its force being thus eluded. It now remains for me to mention, that the experiment here ſtated by the way of ſuppoſition, in which the optic axes croſs each other near to the face, was actually made by Dr. Reid, with this reſult, that the two objects appeared in different places, when ſeen by both eyes together;

and

and that the other experiment, in which the optic axes are ſuppoſed to diverge, was made by myſelf, with a ſimilar event. Dr. Reid, however, inſtead of being led, by the termination of his experiment, to impute a fault to the principle from which he had expected a different one, concluded from it, that there was ſomething unnatural, beſide the ſquinting, in the perſon's eyes, upon whom it was made; though it had been previouſly aſcertained, that objects appeared in the ordinary manner to each of them, when ſeparately employed.

My examination of the ſecond claſs of opinions, reſpecting the cauſe of the ſingle appearance of objects to two eyes, being finiſhed, ſome perſon, perhaps, will now ſay; Granting that no error can, at firſt ſight, be ſhown in your arguments againſt thoſe of Dr. Smith and Dr. Reid, is it not a ſufficient reaſon for believing them fallacious, that they prove too much? If objects appear ſingle neither from cuſtom, nor an original property of the eyes, have we not an effect without a cauſe, and muſt there

not

not be ſomething wrong in the facts or reaſoning which lead to ſuch a concluſion? The anſwer I make is as follows: Since viſible place contains in it both viſible diſtance and viſible direction, it is not neceſſary that the ſingle appearance of an object, to both eyes, ſhould depend altogether either upon cuſtom, or an original principle of our conſtitution; for its viſible diſtance to each eye may be learned from feeling, and its viſible direction be given by nature; in which caſe, the unity of its place to the two eyes, will be owing to neither of thoſe cauſes ſingly, but to a combination of both; and this I regard as a ſufficient reply.

THE END OF PART I.

AN

ESSAY

UPON

SINGLE VISION WITH TWO EYES.

PART II.

Of a new Theory respecting Visible Direction, and of a Solution hence derived of the Question, why Objects are seen single with two Eyes.

I NOW proceed to offer a new opinion, why objects are seen single with two eyes; or in other words, why they appear in the same place to both, this being the light in which I view the fact to be explained.

In every part of natural philosophy, accidents often lead to discoveries, which reason alone might not easily have reached. Under this cover I hope to shelter myself from the charge of presumption, in venturing

turing to give the ſolution of a problem, upon which the talents of many perſons of great learning and genius, have been unſucceſsfully employed; for ſhould I prove more fortunate than ſuch men have been, this muſt be attributed to the knowledge of a circumſtance I obſerved by chance, in repeating ſome very common experiments.

The viſible place of an object being compoſed, as I have already ſeveral times remarked, of its viſible diſtance and viſible direction, to ſhow how it may appear the ſame to both eyes, it will be neceſſary to explain, in what manner the diſtance and direction, which are perceived by one eye, may coincide with thoſe which are perceived by the other: and firſt with reſpect to the diſtance.

In judging of diſtance by ſight, we frequently make conſiderable miſtakes, even when the objects are not very remote; but no perſon, I believe, has ever obſerved, that while an object ſeemed to one of his eyes at a certain diſtance, it has appeared to the other to be at a different diſtance, and from this circumſtance alone has been ſeen double;

or, to expreſs the ſame thing in another way, that while the viſible appearance of an object to one eye, covered the viſible appearance of the ſame object to the other eye, the two appearances did not ſeem entirely to coincide, and make one, but were ſeen ſeparate by the two eyes. I do not ſtop to give the reaſon of this fact, which muſt be plain to thoſe who are acquainted with Biſhop Berkeley's theory of viſible diſtance; but proceed to mention, that the difficulty in finding a true and ſufficient cauſe for the union of the two viſible places of one or two objects to two eyes, muſt therefore conſiſt altogether in ſhowing, in what manner the two apparent directions may coincide, conſiſtently with the attending phenomena.

Since Kepler's great diſcovery of the ſeat and manner of viſion, there have been, as far I know, only two theories offered reſpecting the apparent directions of objects. One is, that they are perceived in the direction of lines paſſing from their pictures on the retina, through the centre of the

eye; * the other, that their apparent directions coincide with their visual rays. But both of these theories are inconsistent with the phenomena of single vision with two eyes. For according to neither of them can an object, placed at the concourse of the optic axes, be seen single, unless we have a most accurate knowledge of its distance; nor will either admit two objects to be seen as one, which are situated in the optic axes, whether on this side, or beyond where they meet, unless the united object be referred by sight to their very point of intersection; both of which conclusions are contradicted by experience. It is evident, therefore, that some other theory of visible direction is required, which shall not be liable to these objections; and such a theory, I hope, I shall bring forward in the following propositions,

* Mr. D'Alembert has said (Opuscules Mathematiques, Tom. I. p. 265) that all optical writers before him had regarded it as an axiom, that every visual point is seen in the direction of its visual ray. But the assertion is not well founded. For Kepler long ago taught (Paralipomena in Vitellionem, p. 173) that objects are perceived in lines passing from their pictures upon the retina, through the centre of the eye; in which he was followed by Dechales and Doctor Porterfield; to the latter of whom Dr. Reid improperly attributes the discovery of the same supposed law.

ſitions, after mentioning the meanings which I affix to ſeveral terms I ſhall frequently employ.

EXPLANATION OF TERMS.

I. When a ſmall object is ſo placed with reſpect to either eye, as to be ſeen more diſtinctly than in any other ſituation, I ſay it is then in the *optic axis*, or the axis of that eye; and if another ſmall body be interpoſed between the former and the eye, ſo as to conceal it, and if a line joining the two be produced till it falls upon the cornea, I call this line the *optic axis*, or the axis of the eye; leaving for future determination the preciſe point of the cornea it falls upon, or what part of the retina receives the picture of an object which is placed in it.

II. When the two optic axes are directed to a ſmall object not very diſtant, they may be conceived to form two ſides of a triangle, the baſe of which is the interval between the points of the corneas, where the axes enter the eyes; but if the object be

be very diſtant, then they may be ſuppoſed to be two ſides of a parallelogram, whoſe baſe is the ſame interval. To avoid circumlocution, I ſhall call this interval the *viſual baſe*.

III. If there be drawn a line from the middle of the viſual baſe, through the point of interſection of the optic axes, or parallel to them, if they be parallel to each other, I name it the *common axis*.* This term I believe was invented by Alhazen; but with him it ſignified a line drawn from the centre of the junction of the optic nerves, through the middle of the interval between the centres of the retinas. Such

* It may be ſaid, perhaps, that as I do not define the points of the corneas, upon which the optic axes fall, I cannot, with propriety, deſire the line which connects them to be divided. To this I anſwer, that it is not neceſſary for the purpoſe I have mentioned, that they ſhould be defined; if it be granted to me, and I think it cannot be refuſed, that upon whatever point of the right cornea the right axis falls, the left axis will fall upon a ſimilarly ſituated point of the left cornea; that is, if this point of the right cornea be at any given diſtance from its middle, and upon the inſide of it, the correſponding point of the left cornea will be at the ſame diſtance from the middle of this, and alſo upon its inſide. Whatever extent, therefore, the line connecting theſe places of the corneas may have, its middle point will be the ſame.

Such a line was conſequently immoveable. As the term, however, is not in modern uſe, no miſtake can ariſe from confounding the two meanings, and the reaſon will ſoon be ſeen, why I employ it in the ſenſe I have mentioned. Thoſe who are acquainted with the writings of the older opticians will perceive, that I give it nearly the ſame ſignification as they did to their *common radius*.

PROPOSITION I.

Objects ſituated in the Optic Axis, do not appear to be in that Line, but in the Common Axis.

EVERY perſon knows, that, if an object be viewed through two ſmall holes, one applied to each eye, the two holes appear but as one. The theories hitherto invented afford two explanations of this fact. According to Aguilonius, Dechales, Dr. Porterfield and Dr. Smith, the two holes, or

or rather their borders, will be ſeen in the ſame place as the object viewed through them, and will conſequently appear united, for the ſame reaſon, that the object itſelf is ſeen ſingle. But whoever makes the experiment will diſtinctly perceive, that the united hole is much nearer to him than the object; not to mention, that any fallacy on this head might be corrected by the information from the ſenſe of touch, that the card, or other ſubſtance, in which the holes have been made, is within an inch or leſs of our face. The other explanation is that furniſhed by the theory of Dr. Reid. According to it, the centres of the retinas, which in this experiment receive the pictures of the holes, will, by an original property, repreſent but one. This theory, however, though it makes the two holes to appear one, does not determine where this one is to be ſeen. It cannot be ſeen in only one of the perpendiculars to the images upon the retinas, for no reaſon can be given why this law of viſible direction, which Dr. Reid thinks eſtabliſhed beyond diſpute, if it ope-

rates at all, ſhould not operate upon both eyes at the ſame time; and if it be ſeen by both eyes in ſuch lines, it muſt appear where thoſe lines croſs each other, that is, in the ſame place with the object viewed through the holes, which, as I have already mentioned, is contrary to experience. Nor is it ſeen in any direction, the conſequence of a law affecting both eyes conſidered as one organ, but ſuſpended when each eye is uſed ſeparately. For when the two holes appear one, if we pay attention to its ſituation, and then cloſe one eye, the truly ſingle hole will be ſeen by the eye remaining open, in exactly the ſame direction as the apparently ſingle hole was by both eyes.

Hitherto I have ſuppoſed the holes almoſt touching the face. But they have the ſame unity of appearance, in whatever parts of the optic axes they are placed; whether both be at the ſame diſtance from the eyes, or one be cloſe to the eye in the axis of which it is, and the other almoſt contiguous to the object ſeen through them. If a line, therefore, be drawn from the object to one of the eyes, it will repreſent all

the

the real or tangible positions of the hole, which allow the object to be seen by that eye, and the whole of it will coincide with the optic axis. Let a similar line be drawn to the other eye, and the two must appear but as one line; for if they do not, the two holes in the optic axes will not, at every distance, appear one, whereas experiments prove that they do. This united line will, therefore, represent the visible direction of every object situated in either of the optic axes. But the end of it, which is toward the face, is seen by the right eye to the left, and by the left eye as much to the right. It must be seen then in the middle between the two, and, consequently, in the *common axis*. And as its other extremity coincides with the point where the optic axes intersect each other, the whole of it must lie in the common axis. Hence the truth of the proposition is evident, that *objects, situated in the optic axis, do not appear to be in that line, but in the common axis.*

Many other experiments might be mentioned which demonſtrate the ſame thing. If, for example, the head of a pin, or of a needle, be interpoſed between each eye, and any ſmall object to which both the optic axes are directed, the heads of the two pins or needles will conſtantly appear as one in the common axis. When the heads, however, are near to the eyes, this experiment is not ſo ſatisfactory as the former, ſince, in theſe poſitions, they ſeem as broad tranſparent ſhadows, for reaſons known to every perſon a little converſant in optics; whereas the holes appear well defined, though almoſt touching us. Again; if we hold two thin rulers in ſuch a manner, that their ſharp edges ſhall be in the optic axes, one in each, or rather a little below them, the two edges will be ſeen united in the common axis, and this apparent edge will ſeem of the ſame length with that of either of the real edges, when ſeen alone by the eye in the axis of which it is placed. If inſtead of two rulers we employ two ſtrings of different colours, as red and green, the like unity of appearance

will

will be obſerved. But in this experiment it frequently happens, that, contrary to what we might naturally expect, only one of the ſtrings is ſeen at a time. When, however, only one is ſeen, its apparent ſituation is exactly the ſame as that of the ſtring, compounded, if I may ſo expreſs myſelf, of the two when ſeen together; and hence we have a convincing proof, if any were wanted, that the ſingle appearances of objects muſt depend upon ſome law of viſible direction affecting each eye, when employed by itſelf, in the ſame manner as when it is uſed conjointly with the other.*

PRO-

* Du Tour expected, that if two objects of different colours were ſeen in the ſame place by both eyes, which however he ſays, he was never able to obſerve, the colour of the apparently united object would be compounded of thoſe of the two really ſingle objects. Memoires des Savans Etrangers, Tom. iv. p. 500. And Dr. Reid mentions expreſsly that it is ſo compounded. Inquiry, p. 293. But in all my experiments upon this ſubject I have remarked, that, when the two objects appeared united, each was ſeen, notwithſtanding, in its proper colour; the red, for example, appearing as it were through a tranſparent green, and the green, in the ſame experiment, as through a tranſparent red. Nor is there any thing in this inconſiſtent with the received doctrine of the compoſition of colours. For in every inſtance of the production of a new colour, from rays of different colours being at

ſame

PROPOSITION II.

Objects, situated in the Common Axis, do not appear to be in that Line, but in the Axis of the Eye, by which they are not seen.

THE facts which demonstrate the truth of this proposition, are both numerous and common.

same time sent to the eye, these rays fall upon the same sentient extremities of the same nerve. But, in the case before us, the differently-coloured rays fall upon the sentient extremities of two different nerves, which have no communication with each other, except through the medium of the brain. We have greater reason, therefore, for expecting, that the colours impressed upon the two eyes, should be perceived uncompounded, than there is for two colours being perceived separately, which are impressed upon two different parts of the same eye.

From the fact of the two colours being thus perceived distinct from each other, I would infer, by analogy, a mode of argument indeed often fallacious, that if it were possible for us to hear any one sound with one ear only, and another sound with the other ear only, such sounds would in no case coalesce either wholly or in part, as two sounds frequently do, when heard at the same time by one ear; that consequently, if the sounds of one musical instrument were to be heard by one ear only, and those of another, by the other ear only, we could have little or no perception of harmony from such sounds; and that, if in any succession of sounds emitted by one instrument, we were to hear the 1st, 3d, 5th, and so on, by one ear only, and the 2d, 4th, 6th, and so on, by the other ear only, we would be deprived, in a considerable degree, of the melody of such sounds, as this

seems

common. If a piece of wire, or any other ſubſtance, repreſenting a phyſical line, be placed in the common axis, with one of its extremities near to the viſual baſe, and if both the optic axes be directed to its farther or diſtant extremity, inſtead of one, two wires will be ſeen, meeting each other at their farther ends, and gradually diverging as they approach the face, till they apparently terminate at the eyes. If the right eye be cloſed, the wire which ſeemed to terminate at the left eye, diſappears; and if the left eye be cloſed, then the other wire diſappears; whoſe termination was at the right eye. The real wire, therefore, in the common axis, appears to the right eye to be ſituated in the axis of the left, and to the left eye to be ſituated in the axis of the right, agreeably to what the propoſition aſſerts.

The following experiments will illuſtrate and confirm both this and the preceding propoſition.

ſeems to depend in a great meaſure upon a new impreſſion being made upon the auditory nerve by one ſound, before the impreſſion of the ſound immediately preceding has paſſed away.

propoſition. Through a piece of card, or paſteboard, let two ſmall holes be made, the interval between which is ſuch, that while a very remote object is ſeen through one of them by the right eye, the ſame object may be ſeen through the other by the left eye. Make afterward another hole in the card, or paſteboard, exactly in the middle between the two former; and let the object be viewed through them as before. Theſe, or the outer holes, will now appear one, preciſely where the ſenſe of feeling indicates the middle hole to be; while the middle hole will appear as two, which ſeemingly occupy the places of the real outer ones. The two appearances of the middle hole, which is placed by conſtruction in the common axis, are therefore ſeen in the optic axes; and as the left is not ſeen when the right eye is ſhut, nor the right when the left eye is ſhut, each appearance is obſerved in the axis of the eye, by which it is not ſeen. As I have ſuppoſed the diſtance between the outer holes to be adapted to the interval of the

eyes when they are directed to a very remote object, the optic axes may, in this caſe, be regarded as parallel to each other. The object, therefore, will ſtill be ſeen through thoſe holes, though the diſtance of the card from the eyes be conſiderably varied; and at all the different diſtances, the ſame appearances will be obſerved, as thoſe which have been mentioned.

Again; take three ſtrings of different colours, as red, yellow, and green, and faſten, by means of a pin, one end of each to the ſame point of a table. Place now their looſe ends in ſuch a manner, that when you look at the pin with both eyes, the viſual baſe being parallel to the edge of the table, the red ſtring may lie in the axis of the right eye, the green in that of the left, and the yellow in the common axis. When things are thus diſpoſed, and both eyes are directed to the pin, the red and green ſtrings, inſtead of appearing ſeparate, each in one of the optic axes, and inclined to the viſual baſe or edge of the table, will now be ſeen occupying but one place, either

 together

together or ſucceſſively, as was formerly mentioned, and at right angles to the viſual baſe, or edge of the table; in ſhort, exactly in the ſituation, which the yellow ſtring in reality poſſeſſes; and the yellow ſtring, inſtead of appearing ſingle in the common axis, and perpendicular to the viſual baſe, will now be ſeen as two, each inclined to the baſe; that ſeen by the right eye, apparently occupying the place in reality poſſeſſed by the green ſtring, and that ſeen by the left eye, the place of the red ſtring.

PROPOSITION III.

Objects, ſituated in any Line drawn through the mutual Interſection of the Optic Axes to the Viſual Baſe, do not appear to be in that Line, but in another, drawn through the ſame Interſection, to a Point in the Viſual Baſe diſtant half this Baſe from the ſimilar Extremity of the former Line, towards the left, if the Objects be ſeen by the Right Eye, but towards the right, if ſeen by the Left Eye.

TWO caſes of this propoſition have already been proved. For it has been ſhown by

by the firſt propoſition, that objects, placed in the axis of either eye, appear to it to be ſituated in the common axis. But the common axis is a line drawn thro' the mutual interſection of the optic axes to the viſual baſe, and its termination there is diſtant, by conſtruction, half that baſe, from the ſimilar terminations of the axes of both eyes, to the left of the right axis, and to the right of the left. Again, it has been ſhown by the ſecond propoſition, that objects, placed in the common axis, appear to each eye to be ſituated in the axis of the other; and the terminations of both optic axes, at the viſual baſe, are diſtant half this baſe, from the ſimilar termination of the common axis, the left being to its right, and the right to its left.

Let it now be ſuppoſed that two objects, one placed in the axis of either eye, the right, for inſtance, and the other in the common axis, be viewed at the ſame time by that eye, it is evident that the viſible directions of both will be equally removed to the left, from their real poſitions. But

ſuch an alteration of viſible direction, from real poſition, cannot be imagined to happen, with reſpect to objects placed in the optic and common axes, unleſs a ſimilar effect be, at the ſame time, produced upon ſuch as are ſituated any where between thoſe lines, or in their vicinity. Facts confirm this: If a line, for example, be drawn through the interſection of the optic axes to a point in the viſual baſe, exactly in the middle between the terminations there of the right and common axes, its apparent ſituation, to the right eye, will be found to have the ſame relation to the apparent ſituations of lines placed in the right and common axes, as its real ſituation has to the real ſituations of ſuch lines. And the like will be found, by obſervation, to be true of every other line, which may be drawn through the point of interſection of the optic axes to the viſual baſe.

The whole of what has here been ſaid may be illuſtrated and confirmed, by having again recourſe to the experiments with ſtrings of different colours. In formerly

deſcribing

deſcribing thoſe experiments, I did not mention all the appearances which occurred upon making them, but only ſuch, as had immediate reference to the points then under conſideration. When, for inſtance, a red ſtring was placed in the axis of the right eye, and a green one in that of the left, I ſaid that they both appeared in the common axis. But this is not the only phenomenon to be obſerved with reſpect to their apparent number in this experiment. For as the red ſtring is alſo ſeen by the left eye, and the green by the right, two other ſtrings become viſible, beſide that in the common axis, the apparent poſitions of both of which will be found to be the ſame with thoſe, which ought to follow from the preſent propoſition. Should now a yellow ſtring be placed between the two former, as in the proof of the ſecond propoſition, its appearance to the right eye will biſect the ſpace between the appearances of the red and green ſtrings to that eye; and the like will be true with reſpect to the appearances of the three ſtrings to the left

eye, agreeably to what the ſame propoſition teaches us to expect.

I believe I need ſcarcely remark, that, although in moſt of the proofs and illuſtrations of theſe propoſitions, I have confined myſelf to the viſible appearances of lines *between* the interſection of the optic axes and the viſual baſe, the ſame things, however, muſt be equally true of thoſe lines, when they are produced beyond the interſection, with this difference only, that, while the portions within, ſeem, to the right eye, to be farther ſituated to the left than they really are, but to the left eye farther to the right, the portions beyond the interſection will ſeem to the right eye to the right of their real poſitions, but to the left eye to the left of them. For it is manifeſt, that, if a line be ſeen by one eye in a certain direction, a prolongation of it muſt be ſeen in the ſame direction; and that, if a line be made to turn upon any point in itſelf, the two extremities muſt move contrary ways.

Should the optic axes be parallel to each other, the ſame proofs and illuſtrations will

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ſtill apply, ſince we may here ſuppoſe them to meet at an infinite diſtance from the viſual baſe. In this caſe, the viſible appearances of lines, drawn from this ſuppoſed point of interſection to the viſual baſe, will be parallel to the real lines, and diſtant half this baſe from them, through their whole extent.

AS I have thus, I think, ſufficiently proved, that the apparent directions of objects are governed by a law, different from any which has hitherto been thought to exiſt, I ſhall now proceed to ſtate, in a few words, in what manner the phenomena of ſingle and double viſion with two eyes are dependant upon it.

I formerly mentioned, that, ſince an object is never ſeen double, merely from its being ſeen at different diſtances by the two eyes, the only difficulty in explaining its ſingle appearance conſiſts in ſhowing how its two viſible directions may coincide, conſiſtently with the attending phenomena. But we are enabled to do this, with the ut-

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moſt eaſe, by the theory I have endeavoured to eſtabliſh. For, if the queſtion be concerning an object at the concourſe of the optic axes, I ſay it is ſeen ſingle, becauſe its two ſimilar appearances, in regard to ſize, ſhape, and colour, are ſeen by both eyes in one and the ſame direction, or, if you will, in two directions, which coincide with each other through the whole of their extent. It therefore matters not, whether the diſtance be truly or falſely eſtimated; whether the object be thought to touch our eyes, or to be infinitely remote. And hence we have a reaſon, which no other theory of viſible direction affords, why objects appeared ſingle to the young gentleman mentioned by Mr. Cheſelden, immediately after his being couched, and before he could have learned to judge of diſtance by ſight.

When two ſimilar objects are placed in the optic axes, one in each, at equal diſtances from the eyes, they will appear in the ſame place, and therefore one, for the ſame reaſon that a truly ſingle object, in the concourſe of the optic axes, is ſeen ſingle.

Here

Here again, as the two viſible directions coincide in every point, it is not neceſſary that the united appearance ſhould be judged to be at any particular diſtance; that it ſhould be referred, for inſtance, to the concourſe of the optic axes, where the two other theories of viſible direction are obliged to place it, in oppoſition to the plaineſt obſervations.

Objects, any where in the horopter, will be ſeen ſingle, becauſe their apparent directions to the two eyes will then completely coincide. And for a contrary reaſon, thoſe placed in any other part of the plane of the optic axes will appear double. To make theſe things evident, let a line paſs through the point of interſection of the optic axes, and any given object, to the viſual baſe, which is to be produced, if neceſſary; and let it be called the line of the object's real poſition. Take afterward, in the viſual baſe, or its production, two points, one on each ſide of the line of real poſition, and both diſtant from its termination there, half the viſual baſe. Lines drawn from theſe

points, through the point of interſection of the optic axes, muſt conſequently contain the two viſible poſitions of the object. But when this is ſituated in the horopter, the line of real poſition will coincide with the horopter, and will not therefore reach the viſual baſe, unleſs at an infinite diſtance from the eyes. For which reaſon, the two lines, containing the viſible poſitions of the object, muſt fall upon the viſual baſe at a like diſtance, and muſt conſequently be regarded as coinciding with each other. When the object is not in the horopter, the two lines of viſible direction will be found, by the ſame means, not to coincide.

That I might ſimplify a matter, which under my management, muſt, I fear, ſtill be of difficult apprehenſion, I have, in expreſſing the law of viſion, ſo frequently mentioned, purpoſely confined it to objects ſituated in the plane of the optic axes. But in perſons who do not ſquint, or whoſe eyes are not diſtorted by external violence, the two appearances of an object, ſeen double, are always, either in that plane,

or

or in ſome one parallel to it; ſo that, if the viſual baſe be parallel to the horizon, a line joining the two appearances will, in every caſe, be alſo parallel to the horizon. Whoever then is able to explain, why objects in the plane of the optic axes appear either ſingle or double, may readily give a reaſon for the like appearances of ſuch as are placed any where elſe. Not to ſpend much time, therefore, upon this part of the ſubject, I ſhall ſhortly obſerve, that if planes be ſuppoſed to paſs through the two optic and common axes, perpendicular to that in which they all lie, and if two lines be drawn from any point of the common interſection of the former planes to the viſual baſe, one along each of the perpendicular planes which paſs through the optic axes, theſe two lines will appear as one, in the perpendicular plane of the common axis; the ſingle viſible line, however, poſſeſſing the ſame elevation, in regard to the horizon, as the two real lines: And again, that, if a line be drawn from any point of the ſame interſection to the viſual

baſe, along the perpendicular plane of the common axis, it will appear as two, one in each of the planes which paſs through the optic axes; the two viſible lines having the ſame inclination to the horizon in their progreſs to the viſual baſe, as the real ſingle one. In this manner, every thing may be ſhown to be true, with reſpect to the ſingle and double appearances of objects without the plane of the optic axes, which has already been done with regard to thoſe placed in it. But farther; ſince any point, taken at pleaſure, in the common interſection of the three perpendicular planes, appears ſingle, the whole of the line of interſection muſt appear ſo, and likewiſe every point of a plane made to paſs through it, parallel to the viſual baſe. Such a plane neceſſarily includes the horopter, and is the ſame as that, which is called by Aguilonius the plane of the horopter.

To exemplify the principal property of this plane, I ſhall mention an experiment, which at firſt I did not underſtand, though the

the reſult was a direct conſequence of my own principles. I ſuſpended a fine chord at right angles to the horizon, and retreating a ſtep or two, I looked ſteadily at a point in it, which was upon a level with my eyes. The chord, in theſe circumſtances, appeared ſingle; but whenever I directed my eyes to any other point of it, either above or below the former, two chords would appear, croſſing each other at the part, to which the eyes were directed. In the firſt caſe, the whole chord was in the plane of the horopter, but in every other, only that point of it to which both eyes happened to be turned. A concluſion from this experiment is, that no object, which is truly perpendicular to the horizon, will appear to be ſo, while our bodies are erect, unleſs we direct our eyes to a point in it exactly upon a level with themſelves.

It was once my intention to ſubjoin here ſeveral inſtances, from the moſt approved authors, of inaccurate deſcriptions of the ſingle and double appearances of objects; in order to ſhow, that the theory of viſible

viſible direction, which I have advanced, is not only conſiſtent with the univerſally received facts, but that it alſo diſcovers to us, ſome minute errors, which unguided ſenſe has committed upon this ſubject; it being, perhaps, one of the ſureſt teſts of the ſoundneſs, as well as one of the chief uſes, of theories in philoſophy, that they lead to the knowledge of what, otherwiſe, might have remained for ever hidden. But fearing I have already proved tireſome, I give up this deſign, and haſten to the conſideration of ſome conſequences from my theory, which ſeem to me both curious and important, and which, when firſt mentioned, may appear to carry with them their own refutation.

END OF PART II.

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ESSAY

UPON

SINGLE VISION WITH TWO EYES.

PART III.

Of ſome Conſequences from the foregoing Theory of Objects being ſeen ſingle with two Eyes, together with the Explanation of ſeveral other Phenomena of Viſion.

IT has hitherto, I believe, been thought by opticians, that, if the poſition of the eye be unchanged, the viſible direction of an object will be the ſame, as long as its picture occupies any one point of the retina; and that, in every different poſition of the eye, a picture, which continues to occupy the ſame point of the retina, will repreſent its

object in a different direction. But if the theory be juſt, which I have advanced in the preceding part of this Eſſay, neither of thoſe opinions can be univerſally true. For it follows, from what was there mentioned, that if one of the optic axes be kept fixed, and the other be at different times variouſly bent toward it, objects, though ſituated in the fixed axis, will nevertheleſs change their viſible directions, with every variation of the moveable axis; ſince they muſt always appear in the common axis, which alters its poſition with every change of the moveable axis: And again, that, if the two optic axes ſhould vary their inclinations to each other in ſuch a manner, that the common axis, may, notwithſtanding, remain fixed, an object placed in either optic axis, and following it in every motion, will poſſeſs but one viſible direction, in all this variety of real poſitions. That theſe concluſions from my theory, or rather parts of it, are true in fact, I can aſſert upon the authority of obſervations, and I ſhall now attempt to trace

trace them both to a common principle, by means of ſome experiments, which were inſtituted with a very different view.

When we have looked ſteadily for ſome time at the flame of a candle, or any other luminous body, a coloured ſpot will appear upon every object, to which we ſhortly after direct our eyes, accompanying them in all their motions, and exactly covering the point, which we deſire to ſee the moſt accurately. Whatever therefore can be proved concerning the apparent direction of ſuch a ſpot, in any given poſition of the eyes, muſt likewiſe be true in the ſame poſition of the eyes, with regard to the apparent direction of an object, ſituated at the concurrence of the optic axes; as its pictures muſt occupy, in this caſe, the very parts of the retinas, upon the affections of which the illuſion of the ſpot depends. This being premiſed, I ſhall now relate one or two obſervations, reſpecting the apparent directions of the ſpot, and conſequently upon thoſe of external objects,

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which, as far as I know, have not been mentioned by any other perſon.

1. The ſpot is always ſeen ſingle, whether the ſurface, upon which it is projected, be touching the face, or at the greateſt diſtance from us; and the reaſon is plain. For the parts of the retinas, by whoſe affections from the luminous body it is occaſioned, are thoſe likewiſe which receive the pictures of objects, placed at the interſection of the optic axes; and as ſuch objects always appear ſingle, ſo muſt alſo the ſpot. The fact indeed is ſo open to obſervation, and its cauſe ſo eaſily ſhown, that I ſhould ſcarcely have thought of mentioning it, had not Dr. Darwin* lately told us, that the ſpot is ſeen double, as often as the eyes are directed to an object more or leſs diſtant than the luminous body which gave riſe to it. With reſpect to our different aſſertions upon this point, I ſhall only ſay, that I have made the experiment, I believe, upward of an hundred times, uniformly with

* Philoſoph. Tranſact. for 1786, p. 318. Dr. Darwin indeed, ſays, p. 341, that Buffon had obſerved the ſame fact; *but* it is evident he has miſtaken that author's meaning.

with the ſame reſult; and that, if the ſpot ever appears double, this muſt be from ſome cauſe very wide of a change in the mutual inclination of the optic axes, to which he attributes it.*

2. The ſpot not only appears ſingle in every ordinary poſition of the optic axes, but cannot even be made to appear double, by any means whatſoever. If it be projected, for example, upon a piece of white paper, whoever makes the trial will find, that, although, on preſſing one eye upward or downward, or to either ſide, the paper will be ſeen double, yet the ſpot

* The only way, in which I think it poſſible for the ſpot to appear double, conſiſtently with the univerſally acknowledged fact, that an object at the interſection of the optic axes is always ſeen ſingle, is this, that, when the interſection is near to the face, an object placed in it ſhall not ſend its pictures to the ſame points of the two retinas, as it does, when the interſection is more remote. And ſuch I once hoped to find to be the caſe; for I had formed, upon the ſuppoſition of its truth, a more plauſible account of the manner in which the eyes are fitted to receive, ſucceſſively, pictures equally diſtinct from objects at different diſtances, than any I had met with. But, after many experiments to aſcertain the matter, I was obliged to return to the common opinion, that the picture of an object in the optic axis, whatever be its diſtance from the eye, is always received upon the ſame point of the retina.

will always appear ſingle, and to poſſeſs its former place on the paper, as ſeen by the eye, which is not diſturbed. Before I knew the reſult of this experiment, I had imagined, that, the poſition of one eye being forcibly altered, the external ſituation of the ſpot, which was ſuggeſted by the affection of that eye, would likewiſe be altered, and the ſpot by conſequence be ſeen double. As the event, however, was contrary to my expectation, I began to ſuſpect ſome cauſe of fallacy had been overlooked, which at length I thought might be this, that the ſpot had been ſeen by that eye only whoſe poſition was not diſturbed, the violence, ſuffered by the other, interrupting the due exerciſe of its functions. To determine, therefore, whether my conjecture was well founded or not, I made another experiment, which is mentioned in the following article :

3. Having looked ſteadily for ſome time at the flame of a candle, with *one* eye only, I directed afterward, with both eyes open, my attention to the middle of

of a ſheet of paper, a few feet diſtant; the conſequence of which was, that a ſpot appeared upon it in the ſame manner, as if I had viewed the flame with both eyes, though ſomewhat fainter. My attention remaining fixed upon the ſheet, I now puſhed the eye, by which the ſpot was ſeen, ſucceſſively upward and downward, to the right and to the left, and in every oblique direction; the ſpot however never altered its poſition, but kept conſtantly upon the middle of the appearance of the paper, perceived by the undiſtorted eye, though the appearance of the paper to the diſtorted eye, was always ſeparate from the former, and the ſheet conſequently ſeen double. My conjecture, therefore, was proved to be ill grounded, and all ſuſpicion of fallacy in the former experiment [illegible] ceaſed.

Now it is evident, from theſe two laſt experiments, that the ſituation of the ſpot does not depend upon the bare poſition of the eyes, or elſe, in the former of them, it would have appeared double, and in the latter,

latter, it would have been moved from the middle of the paper, when the only eye by which it was ſeen was puſhed from its place. Neither can it depend upon the bare poſition of the muſcles of the eye, as theſe were alſo moved in the ſame experiments; nor upon any affection whatever of the optic nerve. For ſince this laſt ſubſtance is altogether paſſive, even in thoſe motions of the eyes which do occaſion a change of the ſpot's ſituation, every alteration, induced upon the nerve by thoſe motions, muſt be ultimately aſcribed to a change of its poſition; and we have ſeen, that ſimilar changes of its poſition have been produced by external violence, without any alteration of the ſpot's ſituation. The apparent ſituation of the ſpot being, therefore, dependant upon none of theſe circumſtances, and being at the ſame time affected by the *voluntary* motions of the eye, it muſt, I think, be neceſſarily owing to the *action* of the muſcles, by which theſe motions are performed. Aſſuming then as true, that the apparent direction of an object, which ſends its picture

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to any given point of the retina, depends upon the ſtate of action exiſting at the ſame time in the muſcles of the eye, and conſequently that it cannot be altered, except by a change in the ſtate of that action, I ſhall proceed to trace to this principle, ſeveral phenomena of viſion, particularly the uniform ſingleneſs of the ſpot already deſcribed, and the two facts reſpecting the viſible directions of objects in the optic axis, which were mentioned in the beginning of this part of my Eſſay.

The thing itſelf is univerſally acknowledged, though a diſpute has ariſen whether cuſtom or an original property be the cauſe, that every voluntary motion of one eye, in perſons who do not ſquint, is attended with a correſponding motion in the other. Now as all voluntary motions are produced by muſcular action, it follows, that every ſtate of action, in the muſcles of one eye, has its correſponding ſtate in thoſe of the other, and that the two are conſtantly conjoined. When, therefore, the ſpot appears ſingle to both eyes in their

free positions, the states of action in the muscles must be such, that the direction, in which it is seen by one eye, coincides with that in which it is seen by the other. But, if we push one eye from its place, no change is hereby made in the action of its muscles; for the state of action in those of the free eye is confessedly the same as it was; and it will be attended with a corresponding state in those of the distorted eye; in proof of which it may be observed, that, whenever the pressure is removed, the distorted eye immediately returns to its former position, without the aid of any new muscular effort. The conclusion then is, that, since there has been no alteration in the action of its muscles, neither ought there to be any in the direction of the spot seen by it, which is the fact to be explained.

Hence also is to be derived the true reason, why objects appear double, when one eye is pushed from its place. For as their pictures must fall upon points of the retina in this eye, different from what they formerly

formerly poſſeſſed; and as no change is made, by the diſtortion, upon the viſible direction, ſuggeſted by any part of the retina, the objects will be ſeen by the preſſed eye, exactly in the ſame directions as they would have been, *before* it was preſſed, had the pictures *then* fallen upon the points of the retina, which they *now* occupy. They muſt therefore be *now* ſeen in different directions by the two eyes, and conſequently double. An experiment with a contrary event will confirm this explanation, and likewiſe ſhow more clearly, in what I differ from thoſe who have endeavoured to account for the ſame fact. Both eyes being open, let one of them be puſhed from its ſituation, and let two ſimilar objects, ſuch as two pieces of money of the ſame metal and ſtamp, be afterward ſo placed, that one ſhall lie in each optic axis; theſe two objects will now appear to be one, and the object ſo compounded will be ſeen in the place, to which the undiſturbed eye refers the truly ſingle object lying in its axis.

Another inference from this doctrine is, that, if the eyes are in any very unusual position with respect to each other from the action of their own muscles, as in persons who squint, two objects placed in the optic axes, one in each, will not appear as one object; for each will be seen in the direction, which is determined by the state of action in the muscles of the eye, upon whose retina its picture falls; and as this state, in one eye, does not correspond with that in the other, the directions cannot coincide. This conclusion is verified by the result of an experiment of Dr. Reid upon a person, affected with strabismus, and by that of another, made by myself, both of which have been already related.

To explain, therefore, why an object in the optic axis appears at different times in different directions, though the axis be kept fixed, it is only necessary to show, that, whenever this happens, a change, notwithstanding, occurs in the actions of the muscles which move the eye. With this view, I observe, that the motions of that

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organ may be divided into two ſets; the firſt, conſiſting of thoſe, by which one eye is carried along with the other, upward and downward, to the right and to the left, and in every oblique direction, the interval between the pupils remaining conſtantly the ſame; the ſecond, of the motions of the pupils, or the anterior parts of the eyes, to and from each other. Suppoſing now, that both the optic axes are perpendicular to the viſual baſe; ſhould the left axis be afterward inclined to the right ſide, the natural tendency of the right axis is to incline equally to the ſame ſide, ſo as to preſerve its former parallelifm to the left. This tendency, however, in the right axis to follow the left, may be counteracted by an effort of the muſcles, which regulate the interval of the pupils, until the two axes interſect each other within two or three inches of the face. But it is evident, that the ſame degree of muſcular force will be required to retain the right eye in its original poſition, as is neceſſary to give to the left eye its motion toward the right; and

 hence,

hence, that, in every different inclination of the left axis to the right, an object placed in the latter, though its real position be unchanged, will, nevertheless, appear in a different direction, in consequence of the different state of action in the muscles of the right eye, which accompanies every new degree of inclination of the axes to each other. As the object must always appear in the common axis, the alteration, in this example, of its visible direction, from an *increase* of the mutual inclinations of the optic axes, will be from left to right; but when the inclination decreases, from right to left. If the right axis be the one which is moved, and the left fixed, the alterations of visible direction in an object placed in the latter, from similar changes in their inclinations, will be contrary to those which have just been mentioned.

The reason also can now be made to appear, why an object, preserving constantly its place in the optic axis, may, in a considerable variety of its real positions, possess but one visible direction. For, in such

cases,

caſes, the change of its viſible direction, which might be expected to accompany the motion of the eye in the axis of which it is ſituated, is prevented from occuring, by a tendency to a change of its viſible direction the contrary way, produced by the muſcular actions which regulate the mutual diſtance of the pupils. To know how this happens, ſuppoſe the two optic axes to be parallel to each other, and perpendicular to the viſual baſe; and let a phyſical line be placed in either of them, ſo as entirely to coincide with it. This line will, therefore, not only be in reality perpendicular to the viſual baſe, but will, in the preſent ſtate of things, likewiſe appear ſo.—Incline afterward both the axes equally to the left ſide, and it is manifeſt that the line coinciding, ſay, with the right axis, muſt appear equally inclined. Let now the right axis be kept fixed, and the left be carried back again, and its motion continued, until it be as much inclined toward the right ſide, as itſelf was juſt before, and as the right axis is ſtill to the left ſide; the conſe-

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quence will be, that the line in the right axis muſt again be ſeen perpendicular to the viſual baſe; for ſuch is the preſent poſition of the common axis. Here then we have had two oppoſite cauſes of change of apparent direction acting in ſucceſſion. The muſcular actions, producing the joint motions of the eyes, firſt bent the viſible poſition of a line, in the right optic axis, from a perpendicular to the viſual baſe toward the left; and the muſcular actions, which regulate the mutual diſtances of the pupils, by *increaſing* the inclinations of the axes to each other, moved it afterward, from the left to the right, back again to a perpendicular to the viſual baſe. Let theſe two cauſes act together, and it is plain, that no obſervable effect will be produced by either, as long as they are thus proportioned. When they are not ſo, only the difference of their forces will be exhibited by the phenomena.

But farther; to ſhow the extent of this theory of viſible direction being dependant upon the actions of the muſcles of the eyes,

I ſhall

I ſhall now apply it to the explanation of an inſtance of apparent motion, which at firſt may be thought to furniſh an argument againſt it. Look with one eye, the other being cloſed, at any remote object through a ſmall hole in a card. If you ſhould afterward ſuddenly attempt to view the hole itſelf accurately, with the ſame eye, you will obſerve both it and the diſtant object, particularly the latter, to move from left to right, if the right eye be uſed; but if the left eye be the one employed, then from right to left. Shift now your attention as ſuddenly back from the hole to the object ſeen through it, and both will return to the places they formerly occupied. In this experiment, no real change can be ſuppoſed to have occurred in the poſition of the diſtant object; and had any happened, with reſpect to either the eye or the hole, the object would not have been ſeen through the latter. No other fallacy, therefore, exiſts here, than that things, which are truly at reſt, appear, notwithſtanding, to be in motion,

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The argument, which I have mentioned may hence be derived againſt my theory, is this: The viſible directions of objects, in the optic axis which remained fixed, were formerly ſaid to be altered, becauſe a new ſtate of muſcular exertion was required to keep it ſo, in every different degree of the inclination to it of the moveable axis. But in the laſt experiment, there ſeems no good reaſon for ſuppoſing any change in the inclination of the moveable axis to the other; for, as one eye is cloſed, the obvious intention of directing the two axes to the ſame object, which is, that we may ſee it ſingle, no longer exiſts. If then an apparent lateral motion be, in one inſtance, obſerved in objects truly at reſt, without any change of the interval of the pupils, may not every other motion of the like kind be alſo independant of the muſcular actions, which regulate that interval?

It is evident, that this argument reſts altogether upon the ſuppoſition, that in the experiment juſt mentioned, no alteration occurs in the interval of the pupils. Now, we

we may be easily convinced, that some alteration does occur, by applying a finger to the closed eye, which will, by this means, be felt to move toward the nose, when we endeavour to view the hole accurately, and from the nose, when we carry our attention back again to the remote object. Were, indeed, the opinion of Aguilonius * just, that the mind perceives only those objects distinctly, which are situated at the concourse of the optic axes, whether they are seen with one or with two eyes, both the necessity and the degree of the alteration would be clearly ascertained. But as this opinion is not just, which I mean to prove from experiments in a succeeding part of this volume, I shall proceed to give another reason, and I think the true one, why the interval of the pupils should be as much altered, when we look with one eye at objects successively, which are placed at different distances, as if we were to view them with both.

It is a fact, for which I have the authority of experiments almost without number,

 though

* Optica, p. 84.

though I do not recollect to have ſeen it mentioned by any author beſide Dr. Porterfield, that every change of the mutual poſitions of the optic axes is conjoined, in perſons who do not ſquint, with a change of the power, in both eyes, to refract the rays of light which fall upon them.—When the axes are parallel to each other, the eyes are in their loweſt refracting ſtate; but in their higheſt, when the axes are mutually interſected within two or three inches of the face; every intermediate inclination being alſo conjoined with an intermediate degree of refracting power. Now, ſince thoſe objects are ſeen moſt diſtinctly, the radious pencils from which are accurately brought to points in the retina, it follows, that, although we employ one eye only, the ſame reaſon exiſts for adjuſting its refractive power to their diſtances, as if we ſaw with both. When, therefore, we view a remote object with one eye, we uſe it in its loweſt refracting ſtate, which, I have obſerved, is conjoined with the wideſt interval of the pupils. Should we afterward attempt to

ſee accurately a very near object, the eye will aſſume its higheſt refractive ſtate, and the interval of the pupils be leſſened; the conſequence of which muſt be, that both the objects lying in the optic axes will appear to move in the manner already related.

To finiſh this part of my ſubject, it ſeems only neceſſary to determine, whether the dependance of viſible direction upon the actions of the muſcles of the eyes be eſtabliſhed by nature, or by cuſtom. But facts are here wanting. As far as they go, however, they ſerve to prove, that it ariſes from an original principle of our conſtitution. For Mr. Cheſelden's patient ſaw objects ſingle, and conſequently in the ſame directions with both eyes, immediately after he was couched; and perſons affected with ſquinting from their earlieſt infancy, ſee objects in the ſame directions with the eye they have never been *accuſtomed* to employ, as they do with the other they have conſtantly uſed.

Having thus ſhown in what directions external bodies are ſeen, when their ſitua-

tion with respect to the eye is given, and upon what circumstance the various directions depend, in which a picture upon any one place of the retina can exhibit the object producing it; I should render the theory of visible direction complete, were I now to point out the relative positions of the two lines of direction, in which any two different parts of the retina represent their objects. To ascertain this, the first step must be, to find the place of the retina which receives the picture of an object, whose situation with respect to the external eye is known; and if two such points of the retina were determined, I think the chief difficulty in this matter would then be overcome. But as it appears to me, that the structure of the eye has not yet been sufficiently explained, to enable any person to take this first step, I forbear saying any thing more upon the subject.

END OF THE ESSAY UPON SINGLE VISION WITH TWO EYES.

EXPE-

EXPERIMENTS *and* OBSERVATIONS

ON

SEVERAL SUBJECTS IN OPTICS.

ARTICLE I.

On Visible Position, and Visible Motion.

IN the estimates we make by sight of the situation of external objects, we have always some secret reference to the position of our own bodies, with respect to the plane of the horizon; and from this cause, we often judge such to be at rest, whose relative places to us are continually changing; and others to be in motion, though they may constantly preserve, in regard to us, the same distance and direction. To give

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an inſtance, let us ſuppoſe our eyes firſt directed to a ſtar near to the horizon; ſhould we afterward, by a mere motion of the head, point them to another, ſome degrees above the former, this ſecond ſtar will appear higher than the firſt did. Were we now, while the eyes are kept fixed in relation to the head, and the head in relation to the ſhoulders, to incline the trunk of the body backward, until we bring the optic axes to a third ſtar, this will appear ſtill higher than the ſecond was perceived to be. If inſtead of directing the eyes ſucceſſively to different objects, the ſame object be ſuffered to remain at the concurrence of the optic axes in all theſe different poſitions of the body, it is evident, that it muſt be ſeen to move, during the change from one poſition to another.

The facts I have mentioned are ſo obvious, that I ſhould not have ſpoken of them, had I not intended they ſhould introduce the following queſtion: What is there within us, to indicate theſe poſitions of the body? To me it appears evident, that, ſince they are occaſioned and preſerved by

combinations

combinations of the actions of various voluntary muſcles, ſome feeling muſt attend every ſuch combination, which ſuggeſts, from experience perhaps, the particular poſition produced by it. But in almoſt all the poſitions of the body, the chief part of our muſcular efforts is directed toward ſuſtaining it againſt the influence of its own gravity. Each poſition, therefore, in which this takes place, muſt be attended with a feeling, which ſerves to indicate its relation to the horizontal plane of the earth; and conſequently, if our bodies poſſeſſed no gravity, or, if the thing were poſſible, had we been created unembodied ſpirits, but with the ſame faculties of perception as we enjoy at preſent, we could no more have judged one line to be perpendicular, and another to be parallel to the horizon, than we can at preſent determine, without ſome external aid, which is the eaſtern, and which the weſtern point of the heavens. I ſhall now draw from theſe principles, the explanation of a fact, which was firſt mentioned by one of the moſt ingenious authors

that

that have written upon viſion, but left by him ſtill to be juſtly accounted for.

"I have frequently (ſays Mr. Melvill)* "obſerved, when at ſea, that, though I "preſſed my body and head firmly to a cor- "ner of the cabin, ſo as to be at reſt in "reſpect to every object about me, the diffe- "rent irregular motions of the ſhip, in roll- "ing and pitching, were ſtill diſcernible by "ſight. How is this fact to be recon- "ciled to optical principles? Shall "we conclude that the eye, by the "ſudden motions of the veſſel, is rolled "out of its due poſition? Or, if it retains a "fixed ſituation in the head, is the percep- "tion of the ſhip's motion, owing to a ver- "tigo in the brain, a deception of the ima- "gination, or to what other cauſe?"

I need not, I believe, offer to ſhow, that the fact here ſpoken of, is not owing to any of the cauſes Mr. Melvill has ſpecified. I ſhall therefore, in a few words, point out its dependance upon the principles which have juſt been mentioned.

It is generally known, I ſuppoſe, that when a veſſel at ſea, in the language of ſailors, is

* Edinburgh Phyſical Eſſays, vol. ii. p. 89.

is ſaid to pitch, its two extremities turn upon its ſhorter axis, and that the term of rolling is confined by them to its motions upon the longer axis. In both pitching and rolling then, the relative poſition of a veſſel to a horizontal plane is neceſſarily changed. Conſequently, though, in the above-mentioned experiment, Mr. Melvill's body and head were at reſt with reſpect to every object about him, ſtill a different degree of muſcular effort was required to keep them ſo, in every ſuch different poſition of the veſſel. But each degree of muſcular effort, to ſuſtain his body againſt the operation of its gravity, would ſuggeſt to him its concomitant poſition with regard to the plane of the horizon; each deviation, therefore, of the veſſel from its former ſituation, relatively to the ſame plane, would be perceived, and the veſſel itſelf be ſeen to move. In ſhort, nothing more takes place in this, than in the following experiment: Let a pole be placed upon firm ground, at right angles to the horizon. If, while we are ſtanding erect, it be inclined upon its

lower extremity, ſucceſſively backward and forward, to the right and to the left, theſe motions muſt, without contradiction, be perceived. Suppoſe now, our bodies to be ſimilarly inclined with the pole, during its different poſitions, ſo as to be conſtantly parallel to it; it is evident, that its motions will be as readily perceived in this caſe, as they were, when our bodies were erect; and this is all that happens in the experiment of Mr. Melvill.

Should the neceſſity of ſupporting the body againſt its gravity, by the actions of our voluntary muſcles, be ſuſpended in whole, or in part, our judgments of the ſituation of objects, with reſpect to the horizon, muſt become irregular and uncertain, notwithſtanding any general habit we may have acquired from experience. An inſtance of this, I think, I have obſerved; for I have frequently remarked during a ſea voyage, that, when the wind blew ſo ſtrongly, and in ſuch a direction, as to occaſion the veſſel to heel, or lean much to one ſide, chords freely ſuſpended from the

roof of the cabin, and kept ſtretched by heavy bodies attached to them, have appeared to me, as long as I lay in bed, though they were neceſſarily perpendicular to the horizon, to decline conſiderably from that poſition; while the ſides of the cabin ſeemed, if not perpendicular, at leaſt much leſs inclined to the horizon than they were in reality. My body being here ſupported by the bed, I was conſequently without thoſe feelings, which indicate its poſition with reſpect to the horizon. Objects therefore appeared to me in thoſe ſituations, in which I had been accuſtomed to ſee them. In confirmation of which I may mention, that, when I got up, and ſtood upon the floor of the cabin, the chords ſeemed perpendicular, or nearly ſo, and the ſides of the cabin inclined; for I was now obliged to exert a proper degree of muſcular force, to keep myſelf upright. What I here ſay, however, is from the recollection of things obſerved ſome years ago, when I had no thought of making the uſe of them I now do; for which reaſon,

I may poſſibly have committed ſome trifling error in ſtating them; but none, I believe, ſufficient to affect the theory they are brought to ſupport.

It being my intention to treat, in the preſent article, of ſeveral facts relative to viſible poſition and motion, which ſeem to me to need explanation, without regarding whether or not they depend upon any common cauſe; I paſs to the conſideration of the apparent rotation of objects, when we have become giddy, by turning ourſelves quickly and frequently round.

Some of the older writers upon optics imagined the viſive ſpirits to be contained in the head, as water is in a veſſel, which therefore, when once put in motion by the rotation of our bodies, muſt continue in it for ſome time after this has ceaſed; and to this real circular movement of the viſive ſpirits, while the body is at reſt, they attributed the apparent motions of objects in giddineſs. Dechales* ſaw the weakneſs of this hypotheſis, and conjectured, that

* Curſus Mathemat. Tom. ii. p. 422.

that the phenomenon might be owing to a real movement of the eyes, but produced no fact in proof of his opinion. Dr. Porterfield,* on the contrary, ſuppoſed the difficulty of explaining it to conſiſt in ſhowing, why objects at reſt appear in motion to an eye which is alſo at reſt. The ſolution he offered of this repreſentation of the phenomenon, is not only extremely ingenious, but is, I believe, the only probable one which can be given. It does not apply, however, to the fact which truly exiſts; for I ſhall immediately ſhow, that the eye is not at reſt, as he imagined. The laſt author, I know of, who has touched upon this ſubject, is Dr. Darwin.† His words are, "When any one turns round ra-
"pidly on one foot till he becomes dizzy,
"and falls upon the ground, the ſpectra of
"the ambient objects continue to preſent
"themſelves in rotation, or appear to li-
"brate, and he ſeems to behold them for
"ſome time in motion." I do not indeed pretend

* Treatiſe on the eye. Vol. ii. p. 426.

† Philoſoph. Tranſact. Vol. lxxvi. p. 315.

pretend to underſtand his opinion fully; but this much ſeems clear, that, if ſuch an apparent motion of the ſurrounding objects depends, in any way, upon their ſpectra, or the illuſive repreſentations of thoſe objects, occaſioned by their former impreſſions upon the retinas, no ſimilar motion would be obſerved, were we to turn ourſelves round with our eyes ſhut, and not to open them till we became giddy; for in this caſe, as the ſurrounding objects could not ſend their pictures to the retinas, there would, conſequently, be no ſpectra to preſent themſelves afterward in rotation. But whoever will make the experiment, will find, that objects about him appear to be equally in motion, when he has become giddy by turning himſelf round, whether this has been done with his eyes open or ſhut. I ſhall now venture to propoſe my own opinion upon this ſubject.

If the eye be at reſt, we judge an object to be in motion when its picture falls in ſucceeding times upon different parts of the retina; and if the eye be in motion, we judge

judge an object to be at reſt, as long as the change in the place of its picture upon the retina, holds a certain correſpondence with the change of the eye's poſition. Let us now ſuppoſe the eye to be in motion, while, from ſome diſorder in the ſyſtem of ſenſation, we are either without thoſe feelings, which indicate the various poſitions of the eye, or are not able to attend to them. It is evident, that, in ſuch a ſtate of things, an object at reſt muſt appear to be in motion, ſince it ſends in ſucceeding times its picture to different parts of the retina. And this ſeems to be what happens in giddineſs. I was firſt led to think ſo from obſerving, that, during a ſlight fit of giddineſs I was accidentally ſeized with, a coloured ſpot, occaſioned by looking ſteadily at a luminous body, and upon which I happened at that moment to be making an experiment, was moved in a manner altogether independant of the poſitions I conceived my eyes to poſſeſs. To determine this point, I again produced the ſpot, by looking ſome time at the flame of a candle;

then

then turning myſelf round till I became giddy, I ſuddenly diſcontinued this motion, and directed my eyes to the middle of a ſheet of paper, fixed upon the wall of my chamber. The ſpot now appeared upon the paper, but only for a moment; for it immediately after ſeemed to move to one ſide, and the paper to the other, notwithſtanding I conceived the poſition of my eyes to be in the mean while unchanged. To go on with the experiment, when the paper and ſpot had proceeded to a certain diſtance from each other, they ſuddenly came together again; and this ſeparation and conjunction were alternately repeated a number of times; the limits of the ſeparation gradually becoming leſs, till, at length, the paper and ſpot both appeared to be at reſt, and the latter to be projected upon the middle of the former. I found alſo, upon repeating and varying the experiment a little, that when I had turned myſelf from left to right, the paper moved from right to left, and the ſpot conſequently the contrary way; but that when I had turned from right to left, the paper would then move from left to right.

Theſe

Theſe were the appearances obſerved while I ſtood erect. When I inclined, however, my head in ſuch a manner, as to bring the ſide of my face parallel to the horizon, the ſpot and paper would then move from each other, one upward and the other downward. But all theſe phenomena demonſtrate, that there was a real motion in my eyes at the time I imagined them to be at reſt; for the apparent ſituation of the ſpot, with reſpect to the paper, could not poſſibly have been altered, without a real change of the poſition of thoſe organs. To have the ſame thing proved in another way, I deſired a perſon to turn quickly round, till he became very giddy; then to ſtop himſelf and look ſteadfaſtly at me. He did ſo, and I could plainly ſee, that, although he thought his eyes were fixed, they were in reality moving in their ſockets, firſt toward one ſide, and then toward the other.

The laſt inſtance of viſible motion I ſhall notice, is one which has been mentioned by Mr. Le Cat, in the following words:*

* Traité des Sens, p. 419.

 "Place

" Place a lighted candle at a moderate dif-
" tance from a polifhed body of confiderable
" convexity, fo that the image of the flame,
" which is feen by reflection from it, may
" appear as a fmall luminous point. The
" experiment will fucceed better, if the di-
" rect rays of the flame be intercepted
" from the fight. Clofe, after this, one
" eye, and view the luminous point in a
" carelefs way, *(en revant)* that is to fay,
" with the eye in a relaxed or dilated ftate.
" The point will then be feen enlarged and
" radiated. If you bring now your fin-
" ger to the right of the eye which is open,
" and gradually move it toward the left,
" in order to conceal the luminous point
" from this eye, you will diftinctly perceive
" the fhadow of your finger to proceed from
" left to right, and to pafs over the point
" in a direction, contrary to that which
" you gave it. Should you, afterward,
" move your finger back from right to left,
" and in like manner, if your finger be
" moved from above downward, or from
" below upward, the fhadow will always
proceed

"proceed the contrary way. It is there-
"fore manifeſt, that the ſoul muſt here
"ſee objects inverted, as their images
"in the eye truly are; and that it refers
"impreſſions to thoſe parts of the eye
"where it feels them, and not to the places
"from which the rays are emitted, as
"it does when it poſſeſſes the means
"of rectifying its judgment. Whence
"does this happen? Doubtleſs, becauſe
"the luminous point has neither a high
"nor a low, neither a right nor left ſide,
"nor any well-enlightened object in its
"vicinity, to awaken the attention of the
"ſoul; in ſhort, nothing which can de-
"termine its judgment."

I ſhould ſcarcely have mentioned this experiment, from any reſpect for the authority of its author in optics; but as Haller* ſeems to aſſent to the concluſion he draws from it, that the ſoul ſometimes ſees objects inverted; and as the Abbot Derochon,† a member of that learned body, the Aca-

* Elementa Phyſiologiæ, Tom. v. p. 479.

† Memoires de Phyſique, p. 66.

demy of Sciences of Paris, has lately, but in my opinion unſucceſsfully, attempted to reconcile it to the commonly-received principles of viſion, I think it worth while to ſhow, in a few words, that it is a direct conſequence of the very doctrine Mr. Le Cat means to overthrow by its means.

It would be proper, indeed, to mention before hand, the opinion of the Abbot Derochon; but this I muſt, notwithſtanding, omit doing, as it could not be underſtood without the figure by which he has illuſtrated it. I ſhall obſerve, however, reſpecting it, *firſt*, that it requires the ſide of the finger next to the eye, to be without the leaſt illumination; whereas the experiment will ſucceed, whether it be illuminated or not: *ſecondly*, that, according to it, the experiment ought to ſucceed equally well, whether the image of the flame in the mirror be ſeen as a point, or as a ſurface; though, in truth, it never does ſucceed, except in the latter caſe: *thirdly*, that the apparent ſhadow of the

finger

finger is always much larger than it ought to be, were it ſeen by reflection, as the Abbot thinks: *fourthly*, that, while the eye, mirror, flame, and finger, remain in the ſame poſitions, the ſhadow ſeems at one time larger than at another, owing to the different degrees of relaxation in the eye; but that this, for the reaſon juſt mentioned, ought never to happen, according to his theory: *fifthly*, that, agreeably to his own reaſoning, the ſhadow ought to move in the ſame direction with the finger, which is the very reverſe of the fact to be explained. But as arguments againſt error may be infinitely extended, and as only one ſolution of a phenomenon can be true, the readieſt way of expoſing the inſufficiency of others, is to exhibit that which is juſt.

This, in the preſent caſe, ſeems to lie upon the very ſurface of optical knowledge, and has already been given by others, of various forms of the ſame fact. When the image of the flame is ſeen in the mirror as a point, its rays muſt be accurately

rately collected to a focus in the retina; but when ſeen as a ſurface, this muſt neceſſarily be attributed to their focus being either before or behind it; in either of which caſes, they will occupy a place upon that membrane of ſome aſſignable dimenſions. In the preſent inſtance, their diffuſion over a part of the retina, depends on the focus being behind it; for the eye is now, from a condition of the experiment, in a more relaxed ſtate than it was juſt before, when the rays of the ſame object were brought there accurately to a point. The rays, therefore, which go to the right ſide of the enlightened ſurface of the retina, or picture as I ſhall call it, are thoſe which enter the eye at the right ſide of the pupil, and its left ſide is formed of the rays entering at the left ſide of the pupil; and the like muſt be true of its upper and lower parts. Should we then begin to move a finger from right to left acroſs the eye, the rays forming the right ſide of the picture muſt be firſt intercepted. But from the known fact, that the points of an external object are always in an inverted

poſition,

poſition, with reſpect to the parts of the retina, by the affections of which they are ſuggeſted, when the *right* ſide of the picture there is effaced, the *left* ſide of the external object it ſuggeſts muſt diſappear. And for the ſame reaſon, if the motion of the finger be continued from right to left acroſs the eye, the other parts of the luminous ſurface in the mirror will ſucceſſively vaniſh from left to right, and thereby furniſh the appearance of a ſhadow paſſing over it in that direction.—In like manner, it may be ſhown, that if the finger proceeds from left to right, from above downward, or from below upward, the ſhadow muſt move the oppoſite way.

That this is the true explanation of Mr. Le Cat's experiment, is, I think, plain, both from its intrinſic evidence, and the following conſiderations:—If the mirror be brought within four or five inches of the eye, and the candle be ſo placed, that the image of the flame muſt, from the laws of reflection, be regarded as a mere point;

5 though

though we ſhould now view it with the utmoſt care, and though there ſhould be in its neighbourhood ſome well-enlightened object to awaken the attention of the ſoul, as Mr. Le Cat expreſſes it, ſtill the ſeeming ſhadow will move in a direction contrary to the finger. For the image is now ſo near to the eye, that no exertion we can make is ſufficient to bring its rays to a point upon the retina; the picture, therefore, upon that membrane will be formed of rays paſſing to a focus behind it, which is the only condition neceſſary for the ſucceſs of the experiment. Again, if a ſhort-ſighted perſon ſhould place the mirror at the diſtance of ſome feet from him, complying in other reſpects with Mr. Le Cat's inſtructions, he will conſtantly obſerve the ſhadow to move in the ſame direction with the finger. For, in his eye, the rays of the image, when at ſuch a diſtance, muſt meet before they fall upon the retina. The right ſide, therefore, of the picture upon that membrane, muſt be compoſed, in this caſe, of rays which

enter

enter the eye at the left ſide of the pupil. Conſequently, when theſe are cut off, the left ſide of the apparent luminous ſurface muſt diſappear, and the ſhadow be ſeen to move the ſame way as the finger, when this ſucceſſively intercepts the rays proceeding from the image to the eye.*

* Scheiner obſerved a fact of the like kind (Fundamentum Opticum, p. 33) namely, that, if a ſmall hole, made in any ſubſtance, be held near to the eye, and an opaque body be paſſed between them, from right to left, the left ſide of the hole will firſt diſappear. Mr. Grey afterward took notice (Philoſoph. Tranſact. Vol. xix. p. 286) that a needle he employed in this experiment was ſeen inverted; from which he ſuppoſed that the hole, or ſomething in it, produced the effect of a concave ſpeculum. Mr. Harris, however, ſays (Treatiſe of Optics, p. 141) that it is not the needle, but its ſhadow on the other ſide, which is ſeen, and is the cauſe of the inverted appearance. But the truth is, that the hole is to be regarded as a luminous point, the rays of which fall upon the retina before they are collected to a focus; and hence that the ſame appearances muſt be here obſerved as in the experiment of Mr. Le Cat. In proof of this it may be mentioned, that if the hole be placed at ſuch a diſtance, that the eye may refract its rays accurately to a point on the retina, no ſhadow or image of the needle will be ſeen; that if the hole be ſtill farther removed, and the eye be adapted to a leſs diſtance, the ſhadow or image will again appear, but its poſition will now be upright, and its motion the ſame way as that of the needle itſelf; and laſtly, that, at one given diſtance of the hole, either no ſhadow will appear, or it will be ſeen upright, or it will be ſeen inverted, according as the eye may be made to aſſume different ſtates with reſpect to its power of refraction.

ARTICLE II.

On a ſuppoſed Conſequence of the Duration of Impreſſions upon the Retina; and the Effects of accurate Viſion being confined to a ſingle Point of that Membrane.

FEW things, at firſt, appear more incredible to a perſon, not converſant in optics, than that he does not, at any one time, ſee diſtinctly a ſurface larger than the head of a pin. After he is convinced, by proper trials, of the truth of this, he naturally aſks, Whence comes it then, that, in ordinary viſion, I ſeem to view diſtinctly ſo many objects at once? I go into a crowded ſtreet, and I fancy I have an accurate perception by ſight, of men, houſes, carriages, and many other things, all at the ſame time; whence proceeds this illuſion?

Only one anſwer, as far as I know, has been given to this queſtion. The impreſſions made upon the retina by external objects, do not, it is ſaid, immediately

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ceaſe, along with the reception of the rays which flow from them; and, as in the ordinary mode of viſion, the eye is continually paſſing from object to object, the impreſſion left by a former one may be ſtill vivid, though the eye be directed to another; and hence we may imagine we ſee both of them diſtinctly, though the picture of only one occupies that place of the retina, which alone furniſhes us with accurate viſion.

There are, however, objections to this anſwer, which ſeem to me inſurmountable. For, *in the firſt place*, as the duration of impreſſions on the retina muſt be greater or leſs, according to the vivacity of the pictures which occaſion them, it follows, that, were this anſwer juſt, the apparent field of our diſtinct viſion ought to be in proportion to the quantity of light admitted by the eye; that it ſhould be contracted, therefore, by every cloud which paſſes over us, and be enlarged by every burſt of ſunſhine; that, at mid-day, it ſhould poſſeſs its greateſt extent, and

ought from that time gradually to decreaſe till the evening, when its limits ſhould be nearly the ſame with thoſe of the real field of accurate viſion. *Secondly*, ſince the coloured ſpot, which is produced by looking ſteadily for ſome time at a luminous body, appears projected upon every object to which we direct our eyes, during its continuance, and as ſuch a ſpot is neceſſarily the ſign and effect of the duration of an impreſſion upon the retina; every other viſible appearance from the ſame cauſe ought, in like manner, to have its ſituation determined by the poſition of the eye, as far as this may be occaſioned by the action of its muſcles. No object, therefore, ought to appear ſeparate and diſtinct from others, if the anſwer were true which I am combatting; but, on the contrary, all thoſe to which we ſucceſſively direct our eyes during the limits of the duration of an impreſſion upon the retina, ſhould ſeem crowded into one place; and, conſequently, none of them ſhould be perceived with any tolerable accuracy.—

Such

Such are the conclusions from the truth of this answer. I need scarcely mention, that they are contradicted by experience.

There is another form of the same fact, to which, it may be thought, an explanation taken from the duration of impressions on the retina will better apply; I mean the appearance of a fiery circle, when any red-hot body is moved quickly round. But it seems, to me, that such an explanation cannot even here be admitted. For, if the circle depended upon the cause I have mentioned, it could only be observed as long as the impressions upon the retina were also disposed in the form of a circle. Were this broken upon, which it must be by every movement of the eye, the appearance suggested by the last impression would no longer be so arranged, with respect to the appearance suggested by the present impression, as to lie with it in the circumference of a circle; and hence some very different figure would be observed. Every person, however, may easily convince himself, that the circular form of

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the fiery appearance is equally perceived, whether the eye be at reſt, or be moved in the moſt irregular manner.

If theſe arguments be thought ſufficient for the purpoſe I had in view, it muſt alſo follow from them, ſince the fact ſtill remains to be explained, why we apparently ſee ſo many objects with equal diſtinctneſs at once, that paſt impreſſions upon the retina are perceived as preſent, by means of ſome higher faculty than that of ſight. This faculty cannot, with propriety, be named *memory*, as it is eſſential to a thing's being remembered, that it be perceived as paſt. Nor can it be called *imagination*, ſince we believe in the preſent exiſtence of what it perceives. In one point of view it may ſeem rather a defect in our natures, that we ſhould not be able to diſtinguiſh between things paſt and preſent. However this may be, I am inclined to be of opinion, that many other phenomena, both of thought and external ſenſe, are partly to be reſolved into the ſame general fact. From the preſent inſtance of it,

it, we learn, that ſeveral muſcular actions may be performed, in ſucceſſion, during the leaſt perceptible portion of time.

The queſtion I have juſt treated, naturally gives riſe to another: Would it have been more to our advantage, if accurate viſion, inſtead of being confined to one point of the retina, had been poſſeſſed by every part of that membrane? I anſwer, I think not, for the following reaſons.

Firſt; The diffuſion of ſuch a property over the whole retina would be of little uſe, unleſs our power of attention was alſo increaſed. For we would otherwiſe be ſtill unable to perceive more than one viſible object at once, with diſtinctneſs, ſince, by our preſent conſtitution, we are capable of attending accurately to only one thing at a time. The only benefit, indeed, I can ſee to ariſe from ſuch a condition of the retina, is this, that our attention might be ſhifted more quickly from picture to picture on that membrane, than our eyes can be turned from one external object to another.

another. This advantage, however, would be far out-weighed by an inconvenience accompanying it. For it is a well-known fact, with respect to perception, that we are capable of attending, more or less accurately, to any particular impression upon the senses, in proportion to the force of the other impressions, which are at the same time received. But in the supposed state of the retina, there would be, almost always, several impressios of the same strength as the one to which we might desire particularly to attend; whereas, in its present state, the vivacity of the impression from the object, to which we turn the optic axis, most commonly surpasses, considerably, that of every other upon the same membrane; by which means our attention is rendered less liable to interruption.

Secondly; The extension of accurate vision, to every part of the retina, would deprive us, in great measure, of the help, which we obtain, at present, from the eye, in learning the thoughts of other men.

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As far as I have been able to obſerve, the changes produced by our internal feelings, upon the ſtate of the eye itſelf, are very few, and relate only to the quantity of moiſture, which is diffuſed over its ſurface, and the degree of fulneſs in the blood-veſſels, which are ſpread upon its white and gliſtening part. Both of theſe circumſtances, however, are ſimilarly altered by oppoſite paſſions, and, conſequently, neither of them can be regarded as the appropriate expreſſion of any. The whole variety, then, of the expreſſions of feeling, which are juſtly attributed to the eye, muſt, I think, depend upon its motions. Some of theſe are the immediate effects of certain paſſions; the eye, for inſtance, being moved differently in anger and in grief; and ſuch may be eſteemed as directly expreſſive of the paſſions by which they are produced. But the far greater number of them do little more, than merely point out the external cauſe, or object of the ſentiment, which the changes of other parts of the countenance declare to

exist within us; or distinguish certain external appearances depending upon a mental cause, from similar appearances arising from a different source. Thus, blushing is often distinguished from an accidental flush of the cheek, by the eye being turned away from the person who occasions it.

That many of the expressions, which we attribute to the eye, do in fact depend on changes in other parts of the countenance, is evident from the alterations we think induced upon it, by the eye-lashes falling off from disease, by a slight inflammation of the edges of the eye-lids, without its being communicated to the eye itself, by artificially colouring the eye-brows, and by many other similar circumstances. And how essential to the right understanding of the expressions of the other features, are the motions of the eyes, when conducted with design, and properly directed, must be known to every one, who has attended in discourse to the countenances of very short-sighted people, and more especially to those of persons afflicted with

blindness.

blindneſs from a *gutta ſerena*, in which the eye, with reſpect to its external condition, ſeems without fault. But whatever is the aſſiſtance the motions of the eye afford, in expreſſing our internal feelings, the whole of it muſt ultimately be referred to the circumſtance of accurate viſion being confined to one point of the retina; ſince the intent of thoſe motions is, to bring the pictures of external objects upon the moſt ſenſible part of that membrane. Their neceſſity, therefore, would no longer exiſt, if the ſame property were extended, and the advantages we at preſent enjoy from them would, conſequently, ceaſe.

ARTICLE III.

On the Connection between the different refractive States of the Eyes, and the different Inclinations of the Optic Axes to each other.

I HAVE mentioned, in my Eſſay upon Single Viſion with Two Eyes,* that I had been convinced, by experiments almoſt without number, that every different degree of the mutual inclination of the optic axes, is attended by a different ſtate of the refracting power of each eye. The experiments I there alluded to were chiefly of this ſort. I placed a luminous point, moſt commonly the reflected image of the flame of a candle from the bulb of a ſmall thermometer, at ſuch a diſtance, that when both my eyes were accurately directed to it, its viſible appearance to one of them was likewiſe that of a point. Keeping then the axis of this eye fixed, and making the other to croſs it, ſometimes before and ſometimes behind the luminous point, I found that in both

* P. 82.

both cases it appeared as a surface to the eye, in the axis of which it was situated; and that the more remote from it was the concurrence of the axes, the larger was the luminous surface. Now when the axes met before the point, the apparent surface must have been occasioned by the rays coming to a focus, previously to their incidence upon the retina; because, when I passed my finger across the eye by which it was seen, its parts disappeared, in an order corresponding to the direction in which the finger moved. The disappearance of the parts was in an order, contrary to the motion of the finger, when my optic axes intersected each other beyond the point; which is an equal proof, that the rays, in that case, tended to a focus behind the retina.

One application of this fact has already been shown,* and I shall now proceed to mention several other phenomena in vision, which it may serve either in whole, or in part, to explain.

1. It

* Essay upon Single Vision, p. 83.

1. It accounts for the following beautiful obſervation made by Aguilonius,† that if we cloſe one eye, and look with the other at an object placed in its own axis, we will not be able to ſee this object diſtinctly, unleſs we alſo direct to it the axis of the cloſed eye. For in perſons, who are neither preſbytic nor myopic, the refractive ſtates of the eyes are ſo adapted to the mutual inclinations of the optic axes, that pencils of rays flowing from bodies at moderate diſtances are more accurately collected upon the retina, when they are ſituated at the interſection of thoſe lines, than if their poſition was, in any conſiderable degree, either nearer or more remote. The reaſon given by Aguilonius himſelf, is, that the mind perceives only thoſe objects diſtinctly, which are placed at the concourſe of the optic axes. But the following experiment proves that the ſolution is true no farther, than as it coincides with the one I have advanced. Hold, in the axis of either eye, a concave lens, at ſuch

† Aguilonii Optica, p. 84.

ſuch a diſtance, that the letters of a book, placed a little farther off, may appear through it very indiſtinct to that eye, when both axes are directed to any particular word. View afterward the lens itſelf with both eyes, and the letters will immediately become more diſtinct. In this experiment then, an object is more accurately perceived when diſtant from the concourſe of the optic axes, than when ſituated exactly in it.

It may be ſaid, perhaps, that the diſtinctneſs of the letters is here to be attributed to the contraction of the pupil, which is occaſioned by the eyes being directed to a nearer object than they were formerly. But that this is not the caſe, may be made evident by another experiment: Place a convex lens in ſuch a manner before one eye, that the flame of a candle, at the diſtance of two or three feet from the face, may appear indiſtinctly terminated to that eye, when both axes are pointed to it. The ſame eye being kept fixed, let the two axes afterward meet

beyond

beyond the flame, and it will now be ſeen much better defined, though the pupil is at the ſame time become larger. The inſufficiency of the explanation of Aguilonius, is alſo proved, by a circumſtance frequently noticed in perſons who are very ſhort-ſighted; for ſuch are obſerved, when they deſire to view an object with much attention, to hold it cloſe to one eye, and to turn the other aſide; in this way occaſioning the two axes to meet very remotely from the object.

2. The reaſon commonly given, why ſhort-ſighted people view an object with one eye only in the manner above-mentioned, is, that by this means they avoid the uneaſy ſtraining of the muſcles, which muſt be employed to direct both axes to the ſame point. But it is evident they muſt derive from the practice this farther advantage, that, as their optic axes are now parallel to each other, or nearly ſo, they, conſequently, ſee the object in the leaſt refractive ſtate of their eyes. Pencils, therefore, will now have their focuſes in the retina, the

the rays of which would have croſſed each other, before they fell upon it, had both the axes been directed to the object.

3. Spectacles were long employed, before the manner in which they aſſiſted ſight was known. About the year 1601, this was propoſed as the ſubject of a queſtion to Kepler,* by his principal patron at that time, Ludovic L. B. a Dietrickſtein, a learned nobleman of Auſtria. The firſt anſwer he gave was, that convex glaſſes were of uſe, by occaſioning objects to appear larger. But his patron obſerved, that if objects were rendered by them more diſtinct, becauſe larger, no perſon would be benefited by concave glaſſes, ſince theſe diminiſh objects. It was not till three years after, that, in conſequence of finding out in what manner viſion is performed, he was able to give a juſt ſolution of this problem, though his attention had been directed to it during the whole of that interval. According to the diſcovery he then made, convex glaſſes were ſaid by him to aſſiſt the ſight of preſ-

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* Paralipomena in Vitellionem, p. 206.

bytic perſons, by ſo altering the directions of rays diverging from a near object, that they ſhall afterward fall upon the eye, as if they had proceeded from a more remote one; and concave glaſſes to benefit the myopic, by producing a contrary effect upon rays which diverge from a diſtant object. Now it is manifeſt, that by this theory, to which I believe no addition has been made by any ſucceeding writer, preciſely the ſame effects are attributed to lenſes, whether they be employed ſingly, or in the form of ſpectacles. I am inclined, however, to think, that a difference, ſometimes at leaſt, exiſts here, which has hitherto eſcaped notice. For in regard to ſuch ſpectacles as I have tried upon myſelf, I have always found, that, when I looked with them at objects placed at moderate diſtances directly before me, my optic axes paſſed through the glaſſes, more inwardly than their centres. With reſpect, therefore, to ſpectacles for long-ſighted people, as the inner halves of their glaſſes may be regarded as two priſms, whoſe refracting angles face each

 other,

other, to have allowed both my eyes to receive through them pencils of rays from the ſame point of an object, the intervals of my pupils muſt have been leſs than was neceſſary for that purpoſe in naked viſion. The conſequence of which would be, an increaſe of the refractive power of my eyes. Again; as the like parts of glaſſes in ſpectacles for ſhort-ſighted perſons, may be eſteemed to be two priſms, the refracting angles of which are turned from each other, the interval of the pupils muſt have been increaſed, and the refracting power of my eyes by this means diminiſhed, when I looked at an object through them, which was directly before me. And effects ſimilar to what I have mentioned, muſt have followed my viewing objects placed obliquely, through glaſſes of both kinds. Here then is one advantage, which perſons, who ſee with both eyes, either do or may enjoy from ſpectacles, but which they cannot derive from uſing ſingle glaſſes. For if they are preſbytic, they can ſee an object by the means of them with a higher refractive ſtate

of the eyes, than if the optic axes met there, as in naked viſion; and if myopic, with a leſs. It is alſo worthy of remark, that this advantage does not ultimately tend to increaſe the evil, which firſt gives occaſion for ſpectacles. On the contrary, if what every writer upon viſion aſſerts be true, that we are apt to become ſhort or long-ſighted, according as we are much accuſtomed to view near or diſtant objects, it muſt ſerve to diminiſh that evil. In ſupport of this opinion, I ſhall mention a fact, with which I have been made acquainted by Mr. George Adams,* of this place, who is not only well ſkilled in the theory of viſion, but, from his ſituation, as an artiſt, has better opportunities, than moſt perſons, of learning ſuch matters. The fact is this, that he does not know a ſhort-ſighted perſon, who has had occaſion to increaſe the depth of his glaſſes, if he began to uſe them in the form of ſpectacles; whereas he can recollect ſeveral inſtances, where thoſe have been obliged to change their concave

* Mathematical Inſtrument Maker to the King.

concave glaſſes repeatedly, for others of higher powers, who had been accuſtomed to apply them to one eye only. This indeed may have happened by accident; but, at any rate, the fact is worthy of farther attention and inquiry.

It would ſeem, however, that the long-ſighted derive more benefit from the alteration in the mutual inclinations of the optic axes, which is produced by ſpectacles, than the ſhort-ſighted. For, as the inner halves of the convex glaſſes are to be regarded as priſms, with their refracting angles continually increaſing as we approach their edges, if two objects, ſituated at different diſtances, be viewed ſucceſſively through them, the inclination of the optic axes to each other, when the nearer object is ſeen, muſt bear a higher proportion to their inclination, when we look at the one more remote, than the different inclinations of the optic axes do to each other, when they are ſucceſſively directed to the ſame objects, without the intervention of ſuch glaſſes. Hence the nearer the object

is,

is, the greater will be the effect of the variation in the inclination of the axes produced by ſpectacles with convex glaſſes; which is the order of things, the beſt adapted to the wants of thoſe who uſe them. But with reſpect to ſhort-ſighted perſons, ſince the refracting angles of their glaſſes, conſidered as priſms, *decreaſe*, in proportion as the objects ſeen through them become more remote; they muſt, conſequently, derive the leaſt benefit from an alteration in the mutual inclinations of the optic axes occaſioned by their ſpectacles, at the time they moſt require it.

If it were aſked, then, what is the real foundation of the common reproach againſt ſpectacles for long-ſighted people? I ſhould anſwer, a very different one from that, which is, for the moſt part, aſſigned.— For the change, in the conformation of the eyes, which renders them uſeful, ſeems to be one of thoſe which nature has deſtined to take place at a particular age, and to which there is no gradual approach through the preceding courſe of life. A perſon, for

inſtance,

inſtance, at forty, ſees an object diſtinctly, at the ſame diſtance that he did at twenty. When he draws near to fifty, the change I have ſpoken of commonly comes on, and obliges him in a ſhort time to wear ſpectacles. As it proceeds, he is under the neceſſity of uſing others with a higher power. But, inſtead of ſuppoſing that his ſight is thus gradually becoming worſe, from a natural proceſs, he attributes the increaſe of the defect in it to his too early and frequent uſe of glaſſes. Upon the whole, I ſhould draw this inference from what has been ſaid, that no perſon, whoſe ſight begins to grow long, ought to be, in the leaſt, prevented from enjoying the immediate advantage which ſpectacles will afford him, by the fear that they will ultimately injure his eyes; not that I think the convexity of each glaſs, conſidered by itſelf, can do no harm, but that I believe the benefit, ariſing from the combination of the two, to be at leaſt ſufficient to compenſate it. Whether thoſe, who have a tendency to ſhort-ſight, ſhould be alſo early in their employment of

ſpectacles,

ſpectacles, I ſhall not pretend to ſay; as there is not the ſame ground, from theory, for ſuppoſing, that the benefit ariſing from the combination of the two glaſſes is able to over-balance the injury, produced by the concavity of each conſidered ſeparately.

All that I have ſaid, however, upon the ſubject of ſpectacles, proceeds upon the ſuppoſition, that, when objects, placed directly before us, at moderate diſtances, are viewed through them, the optic axes penetrate the glaſſes more inwardly than their centres. But I can be by no means ſure, that the interval of the pupils of other perſons bears the ſame proportion, to the interval of the centres of the lenſes in ſpectacles, as that of mine does. It concerns thoſe, therefore, who are chooſing them, to have attention to this circumſtance. To me it appears proper, that the glaſſes in ſpectacles, both for long and ſhort-ſighted people, ſhould be ſo far aſunder, that, when we look at a very remote object directly before us, our optic axes may paſs exactly through their centres. For if the

centres

centres of convex glaſſes be nearer to each other, very remote objects will appear double; and if they are more diſtant, though the object viewed be infinitely far from us, the optic axes will, however, be inclined to one another, and the refractive power of the eyes increaſed, when this may be of diſſervice; ſince there are few eyes which are not able, even without the aid of the convexity of a glaſs, to bring parallel rays to a focus upon the retina. If the centres of lenſes in ſpectacles, for the ſhort-ſighted, be leſs diſtant than what I have mentioned, the optic axes muſt be bent toward each other, when very remote objects are ſeen, and the refractive ſtate of the eye, therefore, heightened, which is the very reverſe of what is here to be deſired. Should the interval of the centres of thoſe lenſes be greater, objects at very conſiderable diſtances will be ſeen double.

There are two other obſervations relative to glaſſes for the ſight, which I wiſh to add to what I have already ſaid upon this ſubject. The firſt is, that the ſingle con-

vex glaſſes with which ſome perſons read, muſt be very injurious, if they be ſufficiently large, to admit the ſame object to be ſeen with both eyes. For as both axes will then paſs through them, one on each ſide of the centre, the interval of the pupils will be widened, and the refracting power of the eyes, be diminiſhed; ſo that here a diſadvantage is to be added to the prejudice of the convexity of the glaſs, not a benefit to be placed againſt it, as in the caſe of common ſpectacles for the long-ſighted. If, indeed, the defect in ſight does not ariſe from the conformation of the eye, but from a want of tranſparency in its cornea or humours, then ſuch glaſſes, by magnifying objects, will be uſeful, for the ſame reaſon, that, in a very faint light, we can read a book of a large print, with more eaſe than one of a ſmaller. The ſecond obſervation is, that if flat-ſided priſms were fixed in ſpectacle-frames, with their refracting angles toward each other, they would aſſiſt the long-ſighted ſomewhat, without producing the evil which is ſaid to

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arise from the convexity of lenses; and spectacles of this kind might, with more propriety, I think, than any others, be called *preservers*. A like combination of such prisms, but with their angles turned the other way, might, when the object was moderately distant, be of service to the short-sighted. But objects, very remote, would be made by them to appear double.

ARTICLE IV.

On the Limits of perfect or distinct Vision.

DR. Jurin,* I believe, was the first who distinguished between *perfect* and *distinct* vision; confining the former term to those cases, where the rays of a single pencil are collected to a single point of the retina; and marking, by the latter, the perception we have of visible objects, when the rays of the pencils, diverging from them, though not collected to single points of

* Essay on distinct and indistinct Vision.

the retina, yet occupy ſo ſmall portions of it, as to allow the objects to be diſtinctly ſeen. But as few authors have adopted this diviſion, I ſhall, in the preſent article, uſe both terms in the ſenſe, which he has appropriated to the firſt. Neither of them is indeed free from objection, ſince bodies to be diſtinctly or perfectly ſeen, not only require, that their pictures ſhould be accurately formed upon the retina, but that they ſhould fall upon a particular part of it.

Although it has long been a ſubject of inquiry, within what limits of diſtance objects are diſtinctly perceived by ſight, yet the only experiments I have met with in books, which have been made, with any tolerable ſhow of accuracy, to determine this matter, are thoſe of Dr. Porterfield. I ſhall not here ſay what they were, as his Treatiſe is in every body's hands, but ſhall only mention, that the principal concluſions which he drew from them were, *firſt*, that objects could be diſtinctly ſeen by him, that is, the pencils of rays

which

which came from them could be accurately collected to points upon the retina, when their diſtances from his eye did not exceed twenty-ſeven inches, and were not leſs than ſeven; and *ſecondly*, that, as often as the axes of both eyes were directed to any one point, ſituated within thoſe diſtances, the rays proceeding from it had their focus in each retina.

As the reſults of ſome experiments, which I have made upon the ſame ſubject, differ from theſe concluſions of Dr. Porterfield, I have read over what he has written upon the matter with more than ordinary attention, and I think I can thence ſhow reaſon, why they ſhould not be received without caution. For, *in the firſt place*, his experiments are related ſo circumſtantially, and with ſuch an appearance of accuracy in the making of them, that you would ſcarcely ſuppoſe he left the leaſt poſſible room for error. And yet, after finiſhing his account of them, he tells us, that he would have repeated them *with more care and exactneſs*,* had he not been

* Treatiſe on the Eye, Vol. I. p. 423.

been interrupted. *Secondly*, his experiments were made upon one eye only, though his conclusions apply to both eyes; an inaccuracy which gives occasion to suspect others. *Lastly*, he says, that he could not see an object distinctly at the distance of seven inches, unless both axes were pointed to another object, at only half that distance. Had he then directed both axes to an object seven inches distant, which he does not mention he ever did, it must consequently have been seen *indistinctly*; and yet one of his conclusions states, that objects, distant from about seven, to about twenty-seven inches, were always *distinctly* seen, when the axes of both eyes were directed to them. Such are the reasons which lead me to think, that the whole of the difference, between the results of the experiments of Dr. Porterfield and myself, is not to be attributed to a difference in the structure of our eyes.

The experiments, which I made upon this subject, were with luminous points. They proved to me, *first*, that, when both

optic

optic axes are directed to any object, placed at a less distance from my eyes than about seventeen inches, my vision of it by the left eye is indistinct, from the rays of light tending to focuses behind the retina; *secondly*, that my vision by the same eye is perfect, if the object seen, and to which both axes are turned, be from about seventeen to about nineteen inches distant; *thirdly*, that the vision of my left eye becomes again imperfect, if the object be moved to a greater distance than that of nineteen inches, the rays being now collected to focuses, previously to their falling upon the retina; and *fourthly*, that I have, by my right eye, imperfect vision of all objects, to which I direct both axes, unless their distances be so great, that the rays of each pencil, proceeding from them, may be regarded as parallel.

A conclusion is furnished by these experiments, similar to one, which was drawn by Mr. Delahire, * from some made by himself; namely, that each eye sees objects dis-

* Memoires de Mathematique et de Physique, 4to. p. 298.

diſtinctly only at one diſtance; as I take for granted, that, in every caſe of ordinary viſion, both axes are directed to the object which is viewed. But Mr. Delahire drew a ſecond concluſion from his experiments, which he ſeems to have regarded only as another expreſſion of the firſt, but which, in truth, includes a very different fact. It was, that the refractive ſtate of the eye is always the ſame, whether we look at a very near or a very diſtant object. The following obſervations, however, will prove the contrary, at the ſame time that they ſhow, in what I farther differ from Dr. Porterfield.

1. Though an object, to which both axes are pointed, does not appear diſtinct to my left eye, unleſs it be from about ſeventeen to about nineteen inches diſtant; nor to my right eye, unleſs it be at a very conſiderable diſtance; yet I find, that when the axes are made to meet at a point, about two inches diſtant from a line connecting the two pupils, which however cannot be effected without much ſtraining, my left

eye

eye will now ſee an object diſtinctly, which is only about ſeven inches from it, and my right eye will at the ſame time ſee an object diſtinctly, the diſtance of which is about ten inches. I find alſo, that my left eye is made to ſee an object diſtinctly, though placed more than nineteen inches from it, if I direct both axes to a point ſtill more remote.

2. I formerly mentioned, that every degree of the mutual inclination of the optic axes is attended, by a particular ſtate of the refracting power of each eye. But I muſt now remark, that theſe ſtates are ſometimes ſubject to ſlight variations, while the inclinations of the optic axes to each other remain the ſame. For I find, that, when a luminous point, to which both axes are turned, is diſtinctly ſeen by my left eye, I can, by certain efforts not eaſily to be deſcribed, but without changing the poſition of either axis, make it afterward appear as a ſurface, and this too, at one time, from the rays coming to a focus too ſoon, and at another, too late, for perfect

vision.* One instance of these variations deserves to be minutely described, as it proves, that the refractive power of the eyes is subject to greater changes, than what are shown by any experiments I have met with in authors. When I look attentively at a bright star, with the optic axes parallel to each other, it appears to my left eye a surface of some extent, and to my right eye, though not a point, yet a surface of very small extent, as small as the sphericity of the cornea and crystaline, the various refrangibility of the different kinds of light, and the width of the pupil at night, can be supposed to allow; for I find, that, if I now pass a needle across the axis of the right eye, its shadow will not be seen. But should I, after

* The variations, however, seem produced in such a manner, that the middle of the set belonging to one degree of the mutual inclination of the optic axes, is always different from the middle of the set belonging to another degree of their inclination; and that, when no other effort is made, than to direct both axes to the same object, the eyes always assume the middle state of the refractive power, which accompanies that particular inclination of the axes. No argument, therefore, can hence be derived against the applications I formerly made of the general fact, respecting the connection of the refractive states of the eyes with the mutual inclinations of the optic axes.

after this, withdraw my accurate attention from the ſtar, and view it in the ſtate of ſight we have, when we are ſaid to be in a *reverie*, in which, though our eyes are open, we are yet ſcarcely conſcious of ſeeing ſurrounding objects, the appearance to the right eye expands itſelf, and if a needle be again paſſed before this eye, its ſhadow will be obſerved to move over the ſtar, in a direction contrary to that of the needle itſelf; a ſure indication that the rays of light now tend to a focus behind the retina. In the ſame ſtate of things, the appearance of the ſtar to the left eye contracts, and if a needle be held before the eye, no ſhadow is ſeen; a ſign that the rays are collected to a focus on the retina; whereas they had formerly croſſed one another before they reached that membrane.

Upon the whole then it is manifeſt, from the experiments I have related, that my left eye can collect to focuſes in the retina, rays which proceed from objects at every diſtance whatſoever, not leſs than ſeven inches; that my right eye can collect to fo-

cuſes in the retina, rays which proceed from objects at every diſtance whatſoever, not leſs than ten inches, and even ſuch as are ſomewhat convergent, ſince it can make thoſe, which are parallel, to meet before they fall upon the retina; and laſtly, that, while both the optic axes are directed to a point within the limits of diſtinct viſion, the rays proceeding from it are never accurately collected to focuſes in both retinas, and ſcarcely ever to a focus in either retina. Theſe are likewiſe the principal circumſtances, in which my experiments differ in their reſults from thoſe of Dr. Porterfield.

In making ſuch experiments with luminous points, one or other of two appearances very conſtantly occurs, neither of which, as far as I know, has been ſpoken of by any preceding author. The moſt proper way of mentioning what they are, is, perhaps, to ſhow what ought to happen in thoſe ſituations, in which they are obſerved.

When a beam of white light paſſes, obliquely, from one medium into another of different refractive power, its variouſly coloured rays muſt begin to diverge from each other, at the point of the beam's incidence upon the latter medium. In achromatic teleſcopes, the mutual ſeparation of theſe rays is checked, and its farther increaſe prevented, before it becomes perceptible to ſenſe, by the contrary refractions which they undergo, from paſſing, ſucceſſively, through the different parts of the object-glaſs. Hence, ſome have imagined, that, ſince objects, in ordinary viſion, are ſeen without colour, as far as this depends on the refractions of the eye, nature has furniſhed us with an inſtrument, conſtituted upon principles ſimilar to thoſe of the object-glaſs of an achromatic teleſcope. But every one, the leaſt acquainted with the ſtructure of the eye, muſt know, that this cannot be the caſe, as the refractions in it are all made one way.* And there are experimental proofs

* There are indeed ſome exceptions to this, but not of ſufficient conſequence to affect the preſent argument.

proofs, that compounded light is always ſeparated into its parts, by paſſing through the eye. For if we interpoſe any opake ſubſtance between us and a luminous body, ſo that only a very ſmall portion of this may remain viſible, it will appear to conſiſt of three differently coloured parts, red, yellow, and blue. The reaſon, therefore, of objects being, for the moſt part, ſeen colourleſs, muſt be elſewhere ſought.*

Now let us ſuppoſe, that a luminous point is the only object which is ſeen at any one time; ſhould the focus of its mean refrangible rays be anterior to the retina, the middle of its picture upon that membrane muſt be chiefly compoſed of the leſs refrangible rays; and this muſt be the reaſon, that, when I look attentively at a bright ſtar with my left eye, the centre of it always appears of a light orange colour. As the beams, however, from the luminous point, which enter the eye near to its axis, ſuffer but

* Dr. Maſkelyne has very learnedly treated this ſubject in the Philoſophical Tranſactions, Vol. lxxix. part 2.

but little refraction, the brightneſs of their white light, will, in great meaſure, overpower the colour given to the middle of the picture upon the retina, by the leſs refrangible rays of thoſe, which enter the eye at a diſtance from its axis. Were you then to intercept the former beams, the effect I have mentioned of the latter, muſt be more obſervable: and hence it is, that when I place a pin or needle between my eye and a luminous point, the rays of which come to a focus before they fall upon the retina, the ſhadow, inſtead of appearing black, is always of a red or deep orange colour; which is one of the phenomena reſpecting luminous points, to which I have alluded.

On the other hand, ſhould the focus of the mean refrangible rays of a luminous point lie behind the retina, the middle of the picture there will be principally formed of the more refrangible rays; and if the beams, which enter the eye near to its axis, be alſo in the preſent caſe intercepted, the effect of the latter rays, in giving colour

to

to the middle of the picture, will consequently be rendered more evident. Hence it is, that, when a luminous point is not sufficiently remote for distinct vision, the seeming shadow upon it, occasioned by any small opake object held before my eye, is always blue; and this is the second of the appearances, which I said are frequently to be observed, in experiments upon luminous points.

THE END.